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ABSTRACT

This report pertains to the scientific and technological manpower resources of the United States. Statistics are presented which relate to women and minorities in the sciences and engineering. This study reports on the findings related to the participation of various groups of women and their career opportunities in science and engineering. (Author/SA)

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FINAL TECHNICAL REPORT

LABOR FORCE PARTICIPATION OF WOMEN TRAINED IN SCIENCE AND ENGINEERING AND FACTORS AFFECTING THEIR PARTICIPATION

BEST COPY AVAILABLE

by

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with assistance from

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Submitted to the

National Science Foundation

by the

Scientific Manpower Commission

June, 1979

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Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of the National Science Foundation.

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PREFACE

The Scientific Manpower Commission was established in 1953 to collect, analyze and disseminate reliable information pertaining to the scientific and technological manpower resources of the United States. In the early 1970's, an increasing national emphasis on equal opportunities for women and minorities led the Commission to compile statistics related to women and minorities in the sciences and engineering, and ultimately to publish that compilation, including data on other professionals, and to keep it current.*

This report focuses on a study of the labor force participation of women trained in science and engineering, including the rates of participation of various groups of women, the opportunities for participation in science and engineering, and the reasons for withdrawal from and plans to return to the labor force.

Inspired by an NSF finding that women trained in science and engineering were less likely to be in the labor force than were all women with similar amounts of education in 1974 - a finding now known to be erroneous - the staff of the Scientific Manpower Commission undertook to investigate as many data sources as would be available over a period of 18 months, and to contact a number of individual women to learn more about the problems behind the statistics.

Our task as we saw it was to learn everything we could about labor force participation of women trained in science and engineering. In the process, we found some intriguing questions we would like to see investigated further such as the relationship of a spouses' field and degree level to the labor force participation and job opportunities of married women scientists and engineers. Our principal finding - that women with training in science and engineering are more likely than all women with similar amounts of education to participate in the labor force has now been confirmed by a revision of the NSF data that inspired our search. We believe the study substantiates our principal recommendation for better statistical monitoring of the numbers and characteristics of women in the science and engineering labor force, so that progress toward utilization of adequate numbers and proportions of women in U.S. science and engineering can be accurately measured and ultimately attained.

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* Professional Women and Minorities - A Manpower Data Resource Service, by Betty M. Vetter, Eleanor L. Babco and Judith E. McIntire, First Edition, June 1975; Second Edition, November 1978

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The financial support from the Scientific and Technical Personnel Studies Section of the National Science Foundation has been noted above and is gratefully acknowledged. The assistance of the staff of the Manpower Analysis Branch in the STPSS in providing pre-publication information through computer printouts of its data, including special questions on the 1978 survey instrument, and running special tabulations needed for this study, is sincerely appreciated.

The assistance of a number of schools in providing current addresses of their women science graduates over the past 15 years made possible the examination of about 600 case studies from which conclusions about common problems could be drawn.

Finally, the cooperation of Lewis Solmon and his colleagues at the Higher Education Research Institute in running computer tabulations on a specialized segment of a survey conducted for other purposes allowed us to examine an older cohort of women science graduates.

To these and the many other individuals who helped us, the SMC expresses its sincere thanks.

SUMMARY OF FINDINGS

- ALTHOUGH THE PROPORTION OF WOMEN AMONG SCIENTISTS AND ENGINEERS REMAINS WELL BELOW THEIR PROPORTION OF THE POPULATION, THEIR SHARE OF EARNED DEGREES IN THE SCIENCES IS INCREASING STEADILY.

Between 1972 and 1976, women's share of earned science and engineering degrees at the bachelor's level rose from 28% to 32.5%; at the master's level from 18% to 22%; and at the doctorate level from 10% to 17%.

However, women are still concentrated in the fields of psychology, social sciences and biological sciences rather than in physical and computer sciences and engineering.

- WOMEN TRAINED IN SCIENCE AND ENGINEERING ARE MORE LIKELY THAN ALL WOMEN COLLEGE GRADUATES TO BE IN THE LABOR FORCE.

About 62% of all women graduates, and 65% to 90% of women science and engineering graduates from the various survey populations in this study were currently in the labor force when surveyed.

The National Science Foundation finding in 1977 that only 53% of women scientists and engineers were in the labor force in 1974 has now been revised to 84.5%

- WOMEN SCIENCE AND ENGINEERING GRADUATES ARE SOMEWHAT MORE LIKELY THAN MEN TO BE EMPLOYED PART-TIME, BUT SIMILAR PROPORTIONS OF BOTH SEXES WHO ARE EMPLOYED PART-TIME ARE SEEKING FULL-TIME EMPLOYMENT.

Among 1974 and 1975 bachelor's graduates in 1976, 13% of men and 16% of women were employed part-time, but about one-fourth of both men and women were seeking full-time jobs.

- IN ALMOST EVERY FIELD OF DEGREE IN SCIENCE OR ENGINEERING, CONSIDERABLY HIGHER PROPORTIONS OF WOMEN GRADUATES THAN OF MEN ARE EMPLOYED OUTSIDE OF SCIENCE AND ENGINEERING: AND HIGHER PROPORTIONS OF WOMEN THAN OF MEN SAY THAT THE REASON IS UNAVAILABILITY OF SCIENCE AND ENGINEERING JOBS.

Among 1974 and 1975 bachelor's graduates in 1976, 47% of men and 69% of women who were employed full-time were employed outside of science and engineering; and 33%

of those men and 36% of the women said this was because no science or engineering jobs were available. Data on master's graduates are similar.

Although much of the total difference is related to field of degree, the difference persists in almost every field.

A similar pattern exists among 1972 and 1976 graduates surveyed in 1978, although the reasons for employment outside science and engineering are not available for these classes.

- THE HIGHER THE EARNED DEGREE LEVEL, THE STRONGER THE ATTACHMENT TO THE LABOR FORCE, REGARDLESS OF ANY OTHER FACTORS.

Labor force participation among the women in the samples analyzed in this study varies with age, parental status and age of children, and field of degree, among other things. Regardless of any of these factors, one or more graduate degrees result in higher labor force participation. The participation rates for women in these samples whose highest degree is the bachelor's range from 55% to 96%. Among women whose highest degree is the doctorate, 86% to 100% are in the labor force while women at the master's level show labor force participation rates ranging from 78% to 96%.

- AMONG RECENT GRADUATES, THE PRINCIPAL REASON FOR BEING OUT OF THE LABOR FORCE IS FULL-TIME GRADUATE STUDY.

Among 1974 and 1975 science and engineering graduates surveyed in 1976, and 1976 graduates surveyed in 1978, about 15% of both men and women were out of the labor force. However, two-thirds of these graduates of both sexes who were out of the labor force were full-time students.

More than 92% of the women among the recent bachelor's and master's graduates in both of these surveys were either full-time graduate students or were in the labor force one to two years after earning that degree.

- AMONG RECENT GRADUATES AT THE BACHELOR'S AND MASTER'S LEVEL, SIMILAR PROPORTIONS OF MEN AND WOMEN ARE INVOLVED IN GRADUATE STUDY.

Among 1974 and 1975 bachelor's graduates in 1976, 40% of men and 36% of women were graduate students. Among the master's graduates of those two years, 31% of men and 32% of women were students in 1976. A majority of graduate students of both sexes are also employed, either full or part-time.

- FIELD OF SCIENCE OR ENGINEERING DEGREE IS STRONGLY RELATED TO LABOR FORCE PARTICIPATION OF WOMEN. IN GENERAL, FIELDS SHOWING STRONG LABOR MARKET DEMAND AS INDICATED BY LOWER UNEMPLOYMENT RATES AND HIGHER SALARY LEVELS ALSO SHOW HIGHER LABOR FORCE PARTICIPATION RATES.

Social sciences, biological sciences, psychology and mathematical sciences are the fields showing the largest proportions of women graduates out of the labor force for all reasons except full-time study. These are also the fields that have the highest unemployment rates for both men and women; the lowest salary scales among the science fields; and the highest proportion of women undergraduates.

Conversely, engineering and the physical sciences, the fields with the lowest unemployment rates for both sexes, the higher salaries within S/E fields, and the smaller proportion of women among graduates show higher proportions of women graduates in the labor force.

- UNEMPLOYMENT RATES FOR WOMEN SCIENTISTS AND ENGINEERS ARE CONSISTENTLY HIGHER THAN FOR MEN, BUT AMONG RECENT GRADUATES THIS DIFFERENTIAL RESULTS PRINCIPALLY FROM THE CONCENTRATION OF WOMEN IN FIELDS SHOWING A HIGHER UNEMPLOYMENT RATE FOR BOTH SEXES.

Among 1976 graduates surveyed in 1978, the unemployment rate for men was 3.0% and for women 5.8% at the bachelor's level; 2.7% for men and 5.4% for women at the master's level. The highest differential in unemployment rates between men and women is in the biological sciences, the social sciences and psychology, where women graduates are concentrated and where the unemployment rates for both sexes are higher than average.

The 1978 unemployment rate of 1972 graduates is 1.6% for men and 3.5% for women who earned a bachelor's degree in 1972; 1.1% for men and 4.0% for women who earned a master's degree in 1972; and the higher unemployment rate for women applies in almost every field.

- IN ALMOST EVERY INSTANCE, SALARIES PAID TO WOMEN ARE BELOW THOSE PAID TO MEN, AND THE SALARY GAP WIDENS WITH AGE.

The salary gap between men and women is less in 1978 for the 1976 class than for the 1972 graduates, but the difference persists in almost all fields.

For women, as for men, salaries for some degree fields are significantly higher than for others. Fields reporting the lowest salaries (the life sciences, the social sciences and psychology) also are the fields with the highest concentration of women.

- AMONG OLDER WOMEN GRADUATES IN SCIENCE AND ENGINEERING, THE PRINCIPAL REASON FOR BEING OUT OF THE LABOR FORCE IS INVOLVEMENT WITH CARE OF PRE-SCHOOL CHILDREN, BUT MOTHERS TRAINED IN SCIENCE AND ENGINEERING ARE MORE LIKELY TO BE IN THE LABOR FORCE THAN ARE ALL MOTHERS WITH FOUR OR MORE YEARS OF COLLEGE, PARTICULARLY WHEN THEIR CHILDREN ARE SIX OR OVER.

The limited information available regarding the labor force participation of mothers trained in science and engineering indicates that 40% to 50% of the mothers in these samples who have degrees in science or engineering and whose children are pre-school age are out of the labor force; but less than 15% of the mothers with children six and over are out of the labor force. Among all women college graduates, about 57% with children under six and 38% of those with children 6 to 17 are out of the labor force.

- WOMEN TRAINED IN SCIENCE AND ENGINEERING WHO TAKE TIME OUT OF THE LABOR FORCE FOR CHILD REARING INDICATE PLANS TO RETURN TO WORK WITHIN A RELATIVELY SHORT TIME PERIOD, AND PROBABLY WILL FOLLOW THEIR PLANS.

Although information on plans to return to the labor force was available for only two samples of women who were currently out of the labor force, 60% to 80% indicated positive plans to return to the labor force.

The fact that about 85% of mothers trained in science and engineering whose children are age six and over are in the labor force, indicates that those still out who say they plan to return undoubtedly will do so.

- THE MAJORITY OF WOMEN SCIENTISTS AND ENGINEERS WHO TAKE CAREER BREAKS OF SIX MONTHS OR MORE FOR REASONS OTHER THAN GRADUATE STUDY GENERALLY PLAN TO RETURN TO THE

LABOR FORCE IN SCIENCE AND ENGINEERING, AND SOME WILL NEED TO UPDATE THEIR SKILLS AND KNOWLEDGE.

In the samples of older women scientists and engineers, about 38% indicate that they have taken a career break of six months or more, but most of them have returned or have plans to return to the labor force. The lack of part-time opportunities in science and engineering hastens withdrawal of women from the labor force and delays their return, thus reinforcing the need for retraining and updating. Very few programs geared to the needs of reentering women scientists and engineers are yet available.

- ALTHOUGH MARRIAGE BY ITSELF DOES NOT STRONGLY AFFECT LABOR FORCE PARTICIPATION OF WOMEN SCIENTISTS AND ENGINEERS, WOMEN MARRIED TO MEN WHO ARE SCIENTISTS ARE SOMEWHAT LESS LIKELY TO FIND EMPLOYMENT IN SCIENCE AND ENGINEERING THAN WHEN THE SPOUSE IS IN AN UNRELATED FIELD; AND WOMEN WHOSE HIGHEST DEGREE IS HIGHER THAN HER HUSBAND'S ARE MORE LIKELY TO BE IN THE LABOR FORCE THAN WHEN HIS DEGREE IS HIGHER THAN HERS.

The one sample which provided information on the marital status and field relatedness of the spouses of women scientists and engineers indicates that women below the doctorate level who were married to men in a related science field were less likely to be employed in science and engineering than when the spouse was in an unrelated field, perhaps indicating more difficulty in finding two science or engineering jobs in one family.

An even stronger relationship occurred in this small sample of 345 married women chemists and engineers between her participation in the labor force and their comparative highest degree level. When her highest degree was higher than his, she was three and a half times as likely to be in the labor force as when his highest degree was higher than hers.

- SIGNIFICANT NUMBERS OF WOMEN WITH SOME PREVIOUS TRAINING IN SCIENCE AND ENGINEERING ARE RETURNING TO COLLEGE, EITHER TO COMPLETE A DEGREE BEGUN EARLIER OR TO UPDATE OR UPGRADE THEIR EDUCATIONAL CREDENTIALS.

Among the women who earned a bachelor's degree in 1972, 2.6% report that they are full-time students in 1978, as do 3.3% of the women who earned a master's degree in

1972.

Women who were freshmen in 1961 and earned a bachelor's degree in science or engineering but no higher degree by 1971, reported in 1974-75 that 4.3% of them were out of the labor force because they were students. Only 1.6% of the men from that same group report being students 15 years after their freshman year.

- SEX DISCRIMINATION, BOTH OVERT AND COVERT, CONTINUES TO AFFECT EDUCATIONAL AND CAREER OPPORTUNITIES FOR MANY WOMEN IN SCIENCE AND ENGINEERING.

The traditional societal assignment of sex roles provides unique problems for women including those associated with combining career development and a family. Many women who have entered fields which are most strongly male-dominated (engineering, agriculture and the physical sciences) experience particular difficulty in being accepted on their merit.

The overwhelming evidence of salary differentials between comparable men and women indicates continuing discrimination which is lessening among new entrants and widening among experienced professionals.

CHAPTER 1

RATIONALE AND BACKGROUND OF THE STUDY

In 1977, the National Science Foundation published a report[1] which included the astonishing and disturbing finding that among the women scientists and engineers identified by its Manpower Characteristics System in 1974, 47% were out of the labor force - that is, neither working nor seeking work.

The Manpower Characteristics System is a compilation of data from several sources which attempts to delineate the characteristics of the U.S. science and engineering population. These sources include a biennial survey of scientists and engineers who were identified through the 1970 Census; with additional input from surveys of more recent bachelor's and master's graduates obtained through a biennial survey of new entrants; and from additions to the doctoral population from the Doctoral Roster maintained by the National Academy of Sciences.

An NSF report published in September 1976 delineating the characteristics of the scientists and engineers in its Manpower Characteristics System in 1974[2] found that approximately 185,000 women who were either identified in the 1970 Census or were added from later graduating classes were scientists and engineers in 1974. These women made up 9.4% of the total number of 2 million scientists and engineers in the United States that year. However, NSF found that almost half of the women in this population (47%) were out of the labor force in 1974 compared to only 12% of male scientists and engineers.

This finding was particularly startling, since among all women with five or more years of college, only 30% were out of the labor force[3] and among all women with four or more years of college, only 36% were out of the labor force in 1974.[4]

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[1] Women and Minorities in Science and Engineering, NSF 77-304, National Science Foundation, January 1977

[2] U. S. Scientists and Engineers: 1974, NSF 76-329, National Science Foundation, September, 1976

[3] Monthly Labor Review, January, 1977, U. S. Department of Labor, Bureau of Labor Statistics

In the natural and social sciences, women earned 39% of the bachelor's, 28% of the master's and 16% of the doctorates that year, and yet NSF found that women made up only 9.4% of all scientists and engineers in the Manpower Characteristics System, and an even smaller 5.8% of those in the science and engineering (S/E) labor force.

Since those NSF studies reporting a 53% labor force participation rate for women scientists and engineers in 1974 were published in 1976 and early 1977, the Foundation has reviewed its data and will publish in the summer of 1979 a revised estimate which lowers the proportion of women among all scientists and engineers in 1974 from 9.4% to 8.7% of the total; increases their proportion of the labor force from 5.8% to 8.0%; and shows their labor force participation rate as 84.5% rather than 53%.

The revised data also show significant differences in numbers of women in some fields, proportions of women in the labor force and unemployment rates (Table 1.1).

TABLE 1.1

WOMEN SCIENTISTS AND ENGINEERS IN 1974

NSF DATA ORIGNIALLY PUBLISHED IN 1976 AND REVISED IN 1979

FIELD	TOTAL NUMBER		NUMBER IN LABOR FORCE		% IN LABOR FORCE		PROPORTION OF LABOR FORCE		UNEMPLOYMENT RATE	
	1976 Original	1979 Revised	1976 Original	1979 Revised	1976 Orig.	1979 Revised	1976 Orig.	1979 Revised	1976 Orig.	1979 Revised
All Fields	185,200	216,800	97,800	183,300	52.8	84.5	5.8	8.0	1.8	3.9
Physical Sciences	18,400	20,700	15,000	16,600	82.1	80.2	9.5	8.0	4.0	4.2
Math. Sciences	15,200	20,000	7,000	13,900	46.1	69.5	15.5	16.5	1.4	2.9
Computer Sciences	24,200	34,600	21,400	31,700	88.4	91.6	17.5	19.0	1.4	1.3
Environ. Sciences	2,700	5,300	1,800	4,400	66.7	83.0	4.0	6.2	-	2.3
Engineering	7,600	6,700	5,300	4,400	59.7	65.7	0.5	0.4	1.9	2.3
Life Sciences	34,100	51,900	18,500	46,000	54.2	88.6	13.5	18.9	1.1	1.7
Psychology	27,100	23,100	15,400	18,800	56.8	90.9	24.8	22.3	2.6	15.4
Social Sciences	55,900	53,000	13,400	45,300	24.0	85.5	13.3	23.5	1.5	4.0

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[4] U. S. Working Women: A Chartbook, Women's Bureau, U.S. Department of Labor, 1975

The revised estimates also change the proportions of men and women at various highest highest degree levels as indicated in Table 1.2

TABLE 1.2

ORIGINAL AND REVISED ESTIMATES OF PROPORTION OF MEN AND WOMEN SCIENTISTS AND ENGINEERS AT EACH DEGREE LEVEL IN 1974

	BACHELOR'S		MASTER'S		DOCTORATE		OTHER	
	1976 Original	1979 Revised	1976 Original	1979 Revised	1976 Original	1979 Revised	1976 Original	1979 Revised
Men	63.7	64.9	19.6	20.9	14.0	11.1	1.3	3.1
Women	62.4	53.7	23.2	27.4	12.5	13.6	1.9	2.4

The revised NSF estimates of labor force participation by women scientists and engineers match well with the findings of this study, which was inspired by the original NSF data, now known to be erroneous.

Design of the Study

This study was designed to investigate the labor force participation of women trained in science and engineering, and the reasons why they were out of the labor force, by analyzing the NSF data sources available at the time the study began in September 1977 and those data resources that would become available by the Spring of 1979. Additionally, we planned to identify and contact a substantial number of women graduates in science and engineering from whom we could obtain more detailed information; and to obtain, if possible, some of the data from a 1974-75 survey of a sample of 1961 freshmen.

The following data sets were analyzed to prepare the findings of this report:

1. A 1976 survey carried out by WESTAT for the National Science Foundation of bachelor's and master's graduates in science and engineering of 1974 and 1975 (Chapter 2).

2. A 1978 survey, also carried out by WESTAT for NSF, of the 1972 and 1976 bachelor's and master's graduates in science and engineering (Chapter 3).

3. Special tabulations obtained from Dr. Lewis Solmon of the Higher Education Research Institute from a 1974-75 Survey of men and women who were freshmen in 1961, and had earned a bachelor's but no higher degree in science and engineering by 1971 (Chapter 4).

4. A survey of approximately 600 women graduates in engineering or in

chemistry over the past fifteen years from a set of selected schools, which was carried out in 1978 by the Scientific Manpower Commission (Chapter 5).

Separate chapters of this report are devoted to the analysis of the data from each of these surveys, and the findings of the study are summarized beginning on page vii

Ideally, the investigators would like to have been able to examine characteristics of women in each of these samples which related field of study and labor force participation with marital status, parental status, present educational level, and age with similar data available for men. This was not possible, since some of the information needed was not collected in some of the surveys. However, a number of other studies provided bench marks which allow comparisons.

Other Relevant Studies

- A study by the U. S. Department of Labor of the educational attainment of workers gave us data on the labor force participation of women by educational attainment in 1977,[5] and shows us a series of relationships between labor force participation and age, marital status, and amount of college education.

TABLE 1.3

PERCENT OF WOMEN COLLEGE GRADUATES IN LABOR FORCE BY AGE AND YEARS OF COLLEGE, 1977

YEARS OF COLLEGE	ALL AGES	20-24	25-34	35-44	45-54	55-64
Four	62.3	86.2	69.8	62.3	66.2	46.2
5 or More	71.5	79.1	77.9	81.4	80.5	66.9

SOURCE: Bureau of Labor Statistics

TABLE 1.4

PERCENT OF WOMEN COLLEGE GRADUATES IN THE LABOR FORCE BY MARITAL STATUS AND AGE, 1977

MARITAL STATUS	ALL AGES	20-24	25-34	35-44	45-54	55-64
Married, Husband Present	59.9	85.4	62.9	62.7	66.4	46.1
Single, Never Married	83.3	84.9	95.1	90.4		n.a.
Widowed, Divorced, Separated	63.5	-	94.4	91.4	80.5	65.7

SOURCE: Bureau of Labor Statistics

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[5] Educational Attainment of Workers, March 1977, Special Labor Force Report 209, Bureau of Labor Statistics, U.S. Department of Labor, 1978

Women with at least some graduate training are more likely to participate in the labor force than are those with only four years of college. Women who are single are about as likely as formerly married women who are 25-54 years old among women college graduates to be in the labor force, and both single and formerly married women are more likely than are women who are married with husbands present to be in the labor force. Nonetheless, even among married women with husbands present, 60% of women college graduates are in the labor force; as are 62.3% of women with four years of college and 71.5% of women with five or more years of college.

- A 1976 study of a group of women scientists and engineers who belong to the professional society for their discipline, conducted by Terence Connolly, Esther Lee Burks and Jean Li Rogers[6] examined in detail a number of major characteristics of 1,125 women who responded to their questionnaire. This sample is called the "Connolly sample" when discussed in later chapters of this report.

The Connolly study examined in some detail the full and part-time labor force participation of those women scientists in terms of their marital and parental status, and found no significant difference in labor force participation of women by marital status, unless they had children at home. Within that sample, 86% of the single women, 89% of the married women without children at home and 83% of the formerly married without children at home were working full-time with various additional proportions working part-time. Even among women with three or more children at home, 59% were working full-time as were 62% of those with two children and 65% of those with one child at home.

That sample of women scientists and engineers was highly educated, with 33% holding a master's as the highest degree and 38% holding the Ph.D. Within that group the level of education had little effect on the likelihood of working full-time, since 78% of the bachelor's, 79% of the master's and 79% of the doctorates did work full-time.

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[6] The Woman Professional in Science and Engineering: An Empirical Study of Key Career Decisions by Terence Connolly, Esther Lee Burks and Jean Li Rogers, Final Technical Report to the National Science Foundation, April 1976

However, an additional 11% of those with doctorate degrees worked part-time compared with 6% of those at the bachelor's level, so that only 4% of the Ph.D. holders were out of the labor force compared with 11% of the women whose highest degree was a bachelor's. Within the total sample, 79% were employed full-time, 9% were employed part-time, 3% were unemployed and seeking work and only 7.4% were out of the labor force. Six percent of the women in the sample were pursuing full-time academic programs leading to a degree.

Table 1.5 shows the proportion of women in that sample with at least a bachelor's degree who were out of the labor force in 1976 by highest degree, marital status and parental status.

TABLE 1.5

LABOR FORCE PARTICIPATION OF WOMEN SCIENTISTS AND ENGINEERS, 1976, BY HIGHEST DEGREE, MARITAL STATUS AND PARENTAL STATUS

	ALL DEGREE LEVELS		BACHELOR'S		MASTER'S		PH.D.	
	No.	% Out of LF	No.	% Out of LF	No.	% Out of LF	No.	% Out of LF
Total Sample	1,031	7.4	281	11.0	350	8.0	400	4.3
No Children	690	3.7	201	5.0	241	4.6	248	2.4
Single	297	3.7	90	5.6	102	5.9	105	-
Married	327	4.0	93	4.3	117	4.3	117	3.4
Formerly Married	66	4.5	18	5.6	22	-	26	7.7
With Children	341	14.4	80	26.3	109	15.6	152	7.2

SOURCE: Connolly, Burks & Rogers

- A 1976 survey of a group of women who received baccalaureates in chemistry over the past 25 years, was conducted by the Women Chemists Committee of the American Chemical Society[7]. Questionnaires were sent to the alumni of ten colleges and universities and 392 useable responses were obtained. Among these women, 52.3% were employed full-time, 15.1% were employed part-time while 32.6% were not employed. However, only 22% indicated that they were not employed by choice. The labor force participation rate is of course higher than the 67.4% who reported being employed. The questionnaire did not ask whether those who were not working were actively seeking work.

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[7] Unpublished data obtained from the Women Chemists Committee of the American Chemical Society

Throughout the present study, the labor force is defined as including all those who are working full-time or part-time, plus those actively seeking work. The unemployment rate is the percentage of the labor force that is unemployed and seeking work.

- A biennial survey of U.S. doctorates, conducted by the National Research Council for the National Science Foundation and others, found that in 1977, 10.5% of women doctoral scientists and engineers and 4.7% of men were out of the labor force.[8]

These studies, in conjunction with the present study, suggest that women trained in science and engineering are at least as likely and probably more likely than women graduates in other areas to participate in the labor force at any one time. Given the somewhat higher level of education for women graduates in science than is typical for all women college graduates, they are significantly more likely than all women college graduates to be in the labor force.

The National Science Foundation's 1979 revised estimates of the 1974 science and engineering population and labor force participation rates reinforce this finding. However, these new data from NSF are so radically different from the numbers published in 1976 about the same population that they also point to a significant need for better statistical monitoring of the numbers and characteristics of both men and women in the science and engineering population.

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[8] Science, Engineering, and Humanities Doctorates in the United States, 1977 Profile, National Academy of Sciences, 1978

CHAPTER 2

1976 SURVEY OF 1974 AND 1975 SCIENCE AND ENGINEERING GRADUATES
(NEW ENTRANTS SURVEY)

Bachelor's Graduates

In 1976, the National Science Foundation surveyed a sample of bachelor's and master's graduates of 1974 and 1975 who had earned degrees in science and engineering. Among the 614,921 graduates at the bachelor's level, 31.1% were women. By field, the proportion of women ranged from 2.4% of the graduates in engineering to 53.2% of those in psychology. The proportion of women in each field is shown in Table 2.1.

At the time of the survey in 1976, 20.1% of the men and 25.3% of the women were not employed. However, 7.1% of the men and 8.9% of the women were seeking employmen The remaining 13.1% of men and 16.4% of women were out of the labor force (Table 2.3).

Because this study is concerned both with determining the extent of labor force participation among women graduates in science and engineering, and with finding out why women with such training may be out of the labor force, we examined all the available characteristics by field and sex of this combined two-year group of baccalaureate recipients in order to find any existing relationships between each characteristic and the labor force participation of women. We examined student status, field of employment, full-time and part-time employment and the proportion seeking full-time when employed part-time, reason for non-science related employment, and the unemployment rate. That rate was determined for each sex and field by dividing the number seeking work by the number in the labor force, which in turn is made up of all employed persons plus all who are actively seeking employment.

We found a positive relationship between the proportion of women out of the labor force with four and possibly five characteristics which could be examined from the survey data available. The major correlation is full-time student status.

With one notable exception (engineering) there is also a positive relationship between the proportion of non-student women who are out of the labor force and (1) high proportion of women among the graduates in a field; (2) high unemployment rates in a field; (3) a low proportion of employed graduates who are employed in the field of their major; and perhaps (4) a high proportion of women graduates in a field relative to the proportion in other science and engineering fields.

TABLE 2.1

SOME CHARACTERISTICS OF BACHELOR'S GRADUATES OF 1974 and 1975, in 1976

	TOTAL	PERCENT					
		By Sex	By Field	In Labor Force	Out of the Labor Force Full Time Student	Out of the Labor Force Part Time Student	Out of the Labor Force Non-Student
TOTAL ALL FIELDS	614,921		100.0				
Men	423,706	68.9	100.0	86.9	10.9	0.6	1.6
Women	191,215	31.1	100.0	83.6	9.6	1.2	5.6
PHYSICAL SCI.	35,601		5.8				
Men	30,057	84.4	7.1	76.2	21.5	0.7	1.6
Women	5,526	15.6	2.9	80.8	13.4	1.6	3.9
MATHEMATICS	40,156		6.5				
Men	25,343	63.1	6.0	90.0	7.1	0.8	2.1
Women	14,813	36.9	7.7	90.9	4.0	1.1	4.0
COMPUTER SCI.	9,797		1.6			0.0	
Men	7,393	75.5	1.7	96.2	3.1	0.0	0.7
Women	2,405	24.4	1.3	95.9	1.9	0.0	2.2
ENVIRON. SCI.	6,581		1.1				
Men	5,544	84.3	1.3	89.7	6.5	1.1	2.7
Women	1,036	15.7	0.5	85.6	12.3	0.0	2.1
ENGINEERING	98,548		16.0				
Men	96,194	97.6	22.7	95.8	3.2	0.3	0.7
Women	2,354	2.4	1.2		3.0	3.0	5.9
BIOLOGY	109,276		17.8				
Men	72,989	66.8	17.2	72.7	24.5	0.8	2.0
Women	36,286	33.2	19.0	79.0	15.1	0.9	5.0
AGRICULTURE	31,653		5.1				
Men	28,368	89.6	6.7	93.7	4.2	0.7	1.4
Women	3,285	10.4	1.7	87.4	6.4	1.0	5.2
PSYCHOLOGY	103,686		16.9				
Men	48,476	46.8	11.4	86.5	10.7	0.5	2.3
Women	55,210	53.2	28.9	82.3	10.5	0.9	6.3
SOCIAL SCI.	179,623		29.2				
Men	109,323	60.9	25.8	88.6	9.2	0.5	1.7
Women	70,300	39.1	36.8	84.8	7.6	1.5	6.1

SOURCE: National Science Foundation, New Entrants Survey, 1976

Student Status

In 1976, baccalaureate recipients of the classes of 1974 and 1975 were highly involved either in the labor force or in improving their educational credentials by full-time graduate study. Among men, 97.8% were in the labor force or were full-time students outside the labor force, and the combined proportion among women was 93.2% (Table 2.1)

More than a third (38.6%) of these graduates were students (Table 2.2). Among men, 25.2% were full-time and an additional 14.5% were part-time students. Among the women, 20.6% were full-time and 13.4% were part-time students. A majority of these graduate students were also employed. Indeed, 25% of both men and women who were full-time students report that they were also employed full-time, with an additional 23% of both sexes employed part-time. Most of the part-time students also were employed either full or part-time.

In order to determine the effect of student status on non-participation in the labor force, we examined by field the total who were not employed, the number in that group who were seeking employment, the number who were full-time students and the number who were part-time students. These data are shown in Table 2.3.

The proportions of graduates who were out of the labor force were considerably higher for both men and women whose degrees were in biological and physical sciences where graduate study is a prerequisite to most professional work (Table 2.1). The proportion who were full-time students out of the labor force also was highest in these fields for both men and women.

In computer science, engineering, mathematics and agriculture, the proportion of both men and women who were out of the labor force was below 10% and the proportion of non-employed, full-time students in these fields was below 7%. In the social sciences and psychology, 82% to 88% of the graduates were in the labor force, while 8 to 10 percent were non-employed, full-time students.

Almost 5,000 of these graduates were part-time students who were neither employed nor seeking employment. However, this group makes up only 0.5% of men and

TABLE 2.2

STUDENT AND EMPLOYMENT STATUS OF 1974 AND 1975 BACHELOR'S GRADUATES IN 1976 BY SEX

STUDENT STATUS & SEX	TOTAL STATUS KNOWN			EMPLOYMENT STATUS											
				EMPLOYED FULL TIME			EMPLOYED PART TIME			NOT EMPLOYED NOT SEEKING			UNEMPLOYED & SEEKING		
	No.	H%	V%	No.	H%	V%	No.	H%	V%	No.	H%	V%	No.	H%	V%
TOTAL															
Men	419,171	100.0	100.0	292,578	69.8	100.0	42,163	10.1	100.0	54,773	13.1	100.0	29,657	7.1	100.0
Women	189,640	100.0	100.0	118,976	62.7	100.0	22,674	12.0	100.0	31,149	16.4	100.0	16,840	8.9	100.0
Full Time Student															
Men	105,594	100.0	25.2	26,038	24.7	8.9	25,079	23.8	59.5	45,652	43.3	83.3	6,982	6.6	23.5
Women	39,026	100.0	20.6	9,778	25.1	8.2	8,707	22.3	38.4	18,225	46.7	58.5	1,725	4.4	10.2
Part Time Student															
Men	60,813	100.0	14.5	48,840	80.3	16.7	5,542	9.1	13.1	2,489	4.1	4.5	3,427	5.6	11.6
Women	29,282	100.0	13.4	21,808	74.5	18.3	3,390	11.6	15.0	2,253	7.7	7.2	1,663	5.7	9.9
Total Students															
Men	166,407	100.0	39.7	74,878	45.0	25.6	30,621	18.4	72.6	48,141	28.9	87.9	10,409	6.3	35.1
Women	68,308	100.0	36.0	31,586	46.2	26.5	12,097	17.7	53.4	20,478	30.0	65.7	3,388	5.0	20.1
Non-Students															
Men	252,764	100.0	60.3	217,700	86.1	74.4	16,231	6.4	38.5	6,632	2.6	12.1	19,249	7.6	64.9
Women	121,332	100.0	64.0	87,390	72.0	73.4	4,445	3.7	19.6	10,671	8.8	34.3	13,452	11.1	79.9

SOURCE: National Science Foundation, New Entrants Survey, 1976

TABLE 2.3

STATUS OF 1974 AND 1975 BACHELOR'S GRADUATES WHO WERE NOT EMPLOYED IN 1976

		NOT EMPLOYED					
		SEEKING		NOT SEEKING			
FIELD & SEX	Total Empl. Status Known	Total Not Employed	Seeking Empl.	Not Seeking Total	Full-Time Student	Part Time Student	Non-Student
TOTAL ALL FIELDS	608,811	132,420	46,498	85,922	63,877	4,742	17,303
Men	419,171	84,430	29,657	54,773	45,652	2,489	6,632
Women	189,640	47,989	16,840	31,149	18,225	2,253	10,671
PHYSICAL SCIENCE	35,298	10,299	2,138	8,161	7,154	326	681
Men	29,882	9,002	1,879	7,123	6,412	242	468
Women	5,416	1,297	259	1,038	741	84	213
CHEMISTRY	20,920	6,695	1,256	5,439	4,853	209	377
Men	17,404	5,899	1,130	4,769	4,350	126	293
Women	3,515	795	125	670	502	84	84
PHYSICS	7,679	1,979	499	1,481	1,317	40	123
Men	7,178	1,814	416	1,398	1,235	40	123
Women	501	165	83	83	83	0	0
OTHER PHYS.	6,698	1,625	383	1,242	984	76	181
Men	5,299	1,288	332	956	827	76	53
Women	1,400	337	51	286	157	0	129
MATHEMATICS	39,864	6,788	2,942	3.846	2,424	320	1,102
Men	25,221	4,552	2,038	2,514	1,794	202	518
Women	14,644	2,236	904	1,332	631	118	584
COMPUTER SCIENCE	9,797	527	145	382	277	0	105
Men	7,393	428	145	283	231	0	52
Women	2,405	99	0	99	46	0	52
ENVIRON. SCI	6,581	980	269	711	480	63	167
Men	5,545	792	227	564	355	63	146
Women	1,036	188	42	147	125	0	21
ENGINEERING	97,648	7,705	3,385	4,320	3,157	341	821
Men	95,294	7,225	3,175	4,050	3,090	274	686
Women	2,354	480	210	270	68	68	135
BIOLOGY	107,879	34,992	7,839	27,153	22,938	997	3,218
Men	72,070	24,721	5,077	19,644	17,547	676	1,421
Women	35,808	10,270	2,761	7,509	5,391	322	1,797
AGRICULTURE	31,204	3,879	1,711	2,168	1,386	208	574
Men	27,920	3,053	1,295	1,758	1,184	170	404
Women	3,284	826	416	410	202	38	170
PSYCHOLOGY	103,297	26,857	10,622	16,235	10,908	728	4,599
Men	48,406	11,695	5,158	6,537	5,170	211	1,155
Women	54,891	15,163	5,464	9,699	5,737	517	3,444
SOCIAL SCIENCE	177,242	40,392	17,447	22,945	15,152	1,757	6,035
Men	107,440	22,962	10,663	12,299	9,869	650	1,781
Women	69,801	17,429	6,784	10,645	5,284	1,107	4,255
ECONOMICS	28,273	5,579	2,127	3,452	2,656	133	663
Men	23,625	4,650	1,994	2,656	1,992	133	531
Women	4,647	929	132	796	664	0	132
SOC/ANTHRO	78,397	18,348	8,669	9,679	4,962	1,080	3.673
Men	32,327	6,872	3,788	3,084	1,878	408	797
Women	46,070	11,476	4,881	6,595	3,084	672	2,839
OTHER SOC. SCI.	70,752	16,465	6,651	9,814	7,535	543	1,735
Men	51,488	11,440	4,880	6,560	5,999	109	452
Women	19,084	5,025	1,771	3,254	1,536	435	1,283

1.2% of women whose employment status is known. Among all graduates whose employment status was known, only 1.6% of men and 5.6% of women who were not students were out of the labor force in 1976 (Table 2.1); and only 2.2% of men and 6.8% of women who were not full-time students were out of the labor force. Thus, full-time student status is the single most important characteristic associated with being out of the labor force for both men and women from these recent graduating classes.

The survey instrument used for the NSF study did not directly ask those individuals who were out of the labor force why they were neither employed nor seeking employment. However, since student status was ascertained, it is reasonable to assume that graduate study was the principal reason for non-employment among full-time students.

Proportion of Women Among Graduates in A Field

Women are 31% of these baccalaureate graduates in science and engineering, but their representation was higher in mathematics, biology, psychology and the social sciences (Table 2.1). Except for engineering, these are also the only fields where 5% or more of the women were non-students out of the labor force. Engineering, with 5.9% of women in this category, is the exception to this finding.

Unemployment Rates

The fields with the highest concentration of women graduates (the social sciences, psychology and biology) are also the fields with the highest unemployment rate for both sexes (Table 2.4). There is little difference in the unemployment rate of men and women in these fields, but the larger proportion of women in these high unemployment fields brings the unemployment rate for all of the women graduates from these two years (10.6%) above that for men (8.1%). In the physical sciences, computer sciences and mathematics, the unemployment rate for women is below that for men, while the reverse is true in agriculture and engineering. In the remaining fields, there is less than 1% difference in the unemployment rates of men and women.

The fields showing the highest unemployment rates for women and the highest concentration of women (psychology, the social sciences, biology and mathematics) are

TABLE 2.4

EMPLOYMENT STATUS OF 1974 AND 1975 BACHELOR'S GRADUATES WHO WERE IN THE LABOR FORCE IN 1976, BY FIELD AND SEX

--	Total Empl. Status Known	Total Labor Force	% in Labor Force	Unem- ploymt Rate	EMPLOYED						
						PART TIME				NON-S/E	
								% Seeks F.T.			
					Total Empl.	No.	% of Total	All P.T.	Non Student	% of F.T.	%"No S/E Available"
TOTAL ALL FIELDS	608,811										
Men	419,171	364,398	86.9	8.1	334,741	42,163	12.6	26.3	69.7	47.2	32.7
Women	189,640	158,490	83.6	10.6	141,650	22,674	16.0	28.3	44.3	68.7	35.8
PHYSICAL SCI.	35,298										
Men	29,882	22,759	76.2	8.3	20,880	4,405	21.1	8.0	58.1	35.5	47.3
Women	5,416	4,377	80.8	5.9	4,118	842	20.4	7.1	28.0	33.7	64.6
MATHEMATICS	39,864										
Men	25,221	22,706	90.0	9.0	20,668	1,501	7.4	28.3	70.2	48.7	36.3
Women	14,644	13,311	90.9	6.8	12,407	1,365	11.1	32.8	39.1	56.7	40.5
COMPUTER SCI.	9,797										
Men	7,393	7,110	96.2	2.0	6,965	231	3.3	33.3	0.0	10.2	28.9
Women	2,405	2,307	95.9	0.0	2,307	198	8.7	46.9	100.0	6.9	68.3
ENVIRON. SCI.	6,581										
Men	5,545	4,980	89.8	4.6	4,753	950	20.0	18.0	70.0	38.2	48.9
Women	1,036	890	85.9	4.7	848	226	29.0	11.4	25.3	39.9	80.5
ENGINEERING	97,648										
Men	95,294	91,245	95.8	3.5	88,070	4,822	5.5	21.2	67.2	15.9	30.8
Women	2,354	2,084	88.5	10.1	1,874	0	0.0	0.0	0.0	11.0	0.0
BIOLOGY	107,879										
Men	72,070	52,426	72.7	9.7	47,349	10,633	22.5	24.9	68.9	48.1	50.0
Women	35,808	28,298	79.0	9.8	25,537	4,912	19.2	23.7	44.2	49.0	54.2
AGRICULTURE	31,204										
Men	27,920	26,161	93.7	5.0	24,866	2,470	10.0	35.7	85.3	45.0	33.3
Women	3,284	2,874	87.5	14.5	2,458	562	23.3	47.0	63.3	35.4	72.1
PSYCHOLOGY	103,297										
Men	48,406	41,868	86.5	12.3	36,710	6,192	16.9	35.2	73.3	66.7	34.5
Women	54,891	45,192	82.3	12.1	39,728	7,037	17.8	33.5	57.2	79.7	34.5
SOCIAL SCI.	177,242										
Men	107,440	95,142	88.6	11.2	84,479	10,059	11.9	31.5	66.9	81.0	25.0
Women	69,801	59,156	84.8	11.5	52,372	7,532	14.4	26.9	33.7	80.0	30.8

SOURCE: National Science Foundation, New Entrants Survey, 1976

also the fields showing the highest proportion of non-student women out of the labor force. This finding might be expected. However, engineering, which has relatively few women, also shows a high unemployment rate for women (10.0%) and a higher than average proportion (5.9%) of women out of the labor force who are not students. This finding is surprising on both counts, given the strong demand for engineers in 1976 and the statement reported by employers in both the major surveys of beginning offers to new graduates (The College Placement Council and the Endicott Survey) that employers are anxious to hire more women engineers than are available. The unemployment rate for men in engineering from this combined class of baccalaureate graduates is only 3.5%. The small size of the sample of women engineers may introduce higher sampling error. Women in computer science show a zero unemployment rate, and also a much lower proportion of the total who are non-students out of the labor force (2.2%).

Field of Employment

Also positively related to the incidence of women non-students out of the labor force is a low proportion of women baccalaureate graduates employed in science or engineering. Only half of employed graduates in biology and mathematics, and only 20% in both psychology and the social sciences report employment in science and engineering (Table 2.5). By contrast, two-thirds of employed women graduates in the physical sciences, 89% in engineering, and 93% of those in computer science report employment in science and engineering. Less than four percent of the computer science and physical science graduates are non-students out of the labor force. Again, engineering is an exception.

Proportion of Total Graduates in A Field

Among these science and engineering graduates, the three most popular fields for women were social sciences, psychology and biology. These three fields combined account for 84.7% of all the women graduates; but they account for 89% of all the non-student women who are out of the labor force.

Among male science and engineering graduates, these three fields account for

TABLE 2.5

FIELD OF DEGREE BY FIELD OF EMPLOYMENT OF BACHELOR'S GRADUATES OF 1974 AND 1975, BY SEX

		FIELD OF EMPLOYMENT													
FIELD OF DEGREE	Total Employed	Chem.	Phys.	Other Phys. Sci.	Math	Compu. Sci.	Environ. Sci.	Engrg.	Bio.	Agric.	Psy.	Econ.	Soc/ Anthro.	Other Soc. Sci.	Other Fields
M	14,518	37.2	-	0.6	0.3	1.4	0.6	6.9	8.4	0.3	-	0.3	-	-	21.0
Chem. W	2,762	53.0	-	1.5	-	3.0	-	3.0	13.7	-	-	-	-	-	25.0
M	5,892	2.8	28.6	2.8	0.7	4.9	6.2	18.2	-	-	1.4	-	-	-	21.8
Phys. W	336	-	24.7	-	-	37.5	-	25.0	-	-	-	-	-	-	12.5
Other M	4,854	0.5	0.5	5.9	-	1.1	1.6	9.6	3.7	4.3	-	1.1	-	4.3	46.9
Phys. W	1,038	-	-	12.5	-	2.5	2.5	9.9	7.6	2.5	-	-	-	2.5	59.8
M	20,391	0.9	0.8	1.0	10.4	22.8	0.8	10.0	0.6	0.4	-	1.4	-	0.6	49.9
Math W	12,125	-	0.3	0.3	8.1	22.9	0.7	7.4	0.3	-	-	1.3	-	1.0	57.6
Compu. M	6,913	-	-	-	-	79.0	0.7	8.4	-	-	-	0.8	-	-	11.2
Sci. W	2,306	2.0	-	-	2.3	79.2	-	6.0	-	-	-	-	-	-	10.5
Envir. M	4,586	0.9	-	1.4	0.5	2.7	35.7	11.8	4.5	5.0	-	0.4	-	2.7	34.3
Sci. W	848	-	-	2.5	4.8	4.9	17.2	5.0	17.0	-	-	-	2.4	9.7	36.6
M	86,828	0.2	0.2	0.2	0.1	2.6	0.4	78.5	0.4	0.5	-	-	-	0.2	16.6
Engrg. W	1,874	-	-	-	-	11.2	3.8	70.2	-	3.8	-	-	-	-	11.0
M	46,195	3.9	0.2	-	-	0.9	1.7	4.5	33.2	5.9	0.5	-	-	0.9	48.3
Biol. W	24,721	4.0	-	-	-	-	1.4	0.3	43.4	1.3	-	-	-	0.3	49.2
M	24,198	0.4	-	0.2	0.3	0.2	0.8	4.9	9.6	40.8	-	0.3	-	0.5	41.9
Agric. W	2,382	-	-	-	-	-	-	5.0	29.9	25.5	-	-	-	-	39.6
M	35,627	0.2	0.2	-	0.2	2.3	0.2	2.3	4.3	0.2	19.6	0.2	0.9	2.8	66.4
Psy. W	38,681	-	-	-	-	1.8	-	0.4	2.8	-	14.8	-	0.4	2.0	77.9
M	18,709	-	-	-	0.7	3.5	-	2.8	2.1	0.7	0.7	10.6	-	3.5	75.2
Econ. W	3,586	-	-	-	-	-	-	3.7	-	-	-	3.7	-	-	92.6
Soc/ M	24,776	-	-	-	0.5	1.1	-	2.2	2.2	-	5.5	0.5	6.0	3.9	78.2
Anthro W	33,375	-	-	-	-	0.4	-	-	3.3	-	2.4	-	10.5	3.2	80.1
Other M	39,073	0.3	-	-	-	0.6	-	2.4	0.6	0.6	1.2	0.9	0.3	12.3	80.8
Soc. W	13,608	-	-	-	0.8	0.9	-	-	2.7	0.8	0.9	-	1.7	11.5	80.6

SOURCE: National Science Foundation, New Entrants Survey, 1976

54.4% of the total graduates and 65.7% of non-students out of the labor force.

However, among men, the three most popular fields for major are social science, engineering and biology which together account for 65.7% of all male science and engineering majors. These three fields combined are the source for only 58.6% of the non-student men who are out of the labor force, so the job opportunities by field as measured by field-related employment and unemployment rates may be the only significant indicator. The unemployment rate for men in engineering was only 3.5% compared to 9.7% in biology, 12.3% in psychology and 11.2% in the social sciences.

Part-Time Employment

Among all the employed bachelor's graduates, 12.6% of the men and 16% of the women were employed part-time. Exactly equal proportions of men and women (14.9%) employed part-time in science and engineering were seeking full-time work. However, among those employed part-time in a non-science or engineering job, 28.4% of the men and 34.9% of the women were seeking full-time employment. Among all part-time workers, 26% of men and 28% of women were seeking full-time employment. (Table 2.4).

For men, the degree fields that include the highest proportion of part-time workers seeking full-time work (regardless of student status) are computer sciences, agriculture, psychology and social science. For women, the computer sciences and agriculture show the highest proportion. The largest contrast by sex is a comparison of part-time workers who are non-students. In this group, about 70% of the men and only 44% of the women are seeking full-time employment. The proportion who are employed part-time and seeking full-time is highest for men in agriculture, psychology, mathematics and environmental sciences. For women, the highest proportions of non-students seeking full-time employment are in agriculture, psychology and biology.

The proportions, however, do not tell the whole story. The largest numbers of women part-time workers seeking full-time employment are graduates in psychology, biology and social science. These three fields include 85.2% of all part-time women workers seeking full-time employment. Among men, these three fields make up 69.5% of the total group of part-time workers who are seeking full-time.

Non-Science Employment

Another significant difference by sex in employment of men and women from these classes is in the percent of full-time employees who are employed outside science and engineering. Among men with bachelor's degrees, 47.2% of the full-time employees work outside these fields of employment while for women the proportion is 68.7% (Table 2.4). In some fields, notably the physical sciences, environmental sciences, biology and the social sciences, the proportion of both sexes who are employed full-time outside of science and engineering is approximately equal. In psychology, 66.7% of the men and 79.7% of the women are employed outside of science and engineering. Because this field includes such a high proportion of all women in the survey, this field accounts for much of the discrepancy between the total proportions of men (47.2%) and women (68.7%) who are employed outside of science.

Most likely to be employed in the field of their major are computer scientists and engineers, followed at a distance by physical scientists. Social scientists of both sexes are least likely to be employed in science or engineering and the proportion is similar for both men and women (80.1 and 82.5% respectively).

Asked the reason for non-science employment, approximately one-third of both sexes who responded indicated that no science-related employment was available. Both sex and field differences occur, but in the fields of major where the largest proportion of graduates are in non-science jobs (social sciences, psychology, biology and mathematics) the proportion of each sex who list this reason for non-science employment is similar.

More than a third (37.9%) of the women employed full-time outside of science and engineering said they preferred such employment. This proportion contrasts with 26.9% of the men who worked outside of science and engineering by preference.

Another important reason given by men (12.0%) was better pay in a non-science and engineering job. This was a neglible factor for women. A slightly higher proportion of women (6.4%) than men (5.7%) indicated that location of the job was the reason for non-science and engineering employment.

Summary of Findings

Among bachelor's degree graduates from the classes of 1974 and 1975, 97.8% of the men and 93.2% of the women were either in the labor force or were full-time students in 1976. Women are somewhat more likely than men to be employed part-time (16.0% of employed women and 12.6% of employed men). Among all graduates who are employed full-time, women are much more likely than men to be employed outside of science and engineering (68.7% and 47.2% respectively) but most of this difference is explained by the high concentration of women in psychology and in the social sciences where the proportions of both sexes who are employed outside of science and engineering exceeds 65%.

Among these recent graduates who are in the labor force, 10.6% of the women and 8.1% of the men are unemployed and seeking work. The unemployment rates for both sexes are highest in psychology and the social sciences. The lowest unemployment rates are in computer sciences and in environmental sciences with male engineers also showing a low unemployment rate. Women engineers, surprisingly, show a 10% unemployment rate, although the number of women engineers who are unemployed and seeking work totals only 210.

Among all graduates in these combined classes, 13.1% of the men and 16.4% of the women are out of the labor force - that is they are neither employed nor seeking employment. However, the majority are students. The proportion of men who are out of the labor force and are pursuing full-time graduate study (10.9%) is very similar to the proportion of women in this status (9.6%). Graduates of both sexes in the physical and biological sciences are more likely than graduates in the other fields to be full-time students.

Among those who are out of the labor force, 12.1% of the men and 34.3% of the women are neither full nor part-time students. Among the 17,303 non-students who are neither employed nor seeking work, 6,632 (38.3%) are men and 10,671 (61.7%) are women. Nonetheless, these numbers constitute only 1.6% of the total male graduates and 5.6% of the total female graduates from these combined classes.

The women report a somewhat higher proportion in part-time employment (12%) than men (10.1%). Among part-time employees, 28.3% of the women and 26.3% of the men report that they are seeking full-time employment. Among non-students, 70% of the men and 40% of the women employed part-time are seeking full-time employment.

In most fields, women employed full-time are somewhat less likely than men to be employed in science and engineering, and are more likely to indicate that this is because no science-related job is available. Among 65,123 men and 39,926 women graduates in science and engineering who report their reason for being employed outside of science and engineering, 32.7% of the men and 35.8% of the women say no science or engineering job was available. However, the field difference is more significant than the sex difference. The proportion of both sexes who are employed full-time outside of science and engineering is 81% in the social sciences, 73.4% in psychology and 53.2% in mathematics. Among all the women in this survey, 73.4% have majors in those three fields compared to only 43.2% of the men. Among computer scientists only 9.4% of graduates who are employed full-time are working outside of science or engineering; and in engineering, only 15.8% are working outside; but only 2.5% of all the women in the survey majored in these two fields compared to 24.4% of the men.

Because women report higher unemployment rates, higher proportions of part-time workers seeking full-time jobs, and significantly higher proportions of those who report that they are working outside of science and engineering because no science or engineering job is available, the 10,700 women who report themselves as non-students out of the labor force may also include discouraged job seekers in a higher proportion than may be represented among the 6,600 men in the same category.

The graduates in this survey group were approximately 23 to 25 years old on the average at the time of the survey. Thus, many, if not most of the women reported as out of the labor force who are not full-time students probably have young children.

Master's Graduates

Distribution Among Fields

Among 108,461 master's graduates in science and engineering in 1974 and 1975 who were surveyed in 1976, 19.7% were women. Distribution of degrees within the various fields of science is similar for both men and women to the distribution of bachelor's degrees, except that for men the concentration in engineering increases to more than a third of the total while the proportion majoring in the social sciences drops from almost 26% to 15% (Table 2.6). Among the women, increasing proportions of degrees were granted in the mathematical and physical sciences, with decreases occuring largely in social sciences and psychology. One-fifth of the women obtaining master's degrees earned that degree in biology - approximately the same proportion as among bachelor's degree recipients.

Labor Force Participation

Among these recent graduates, 91.5% of the men are in the labor force as are 87.5% of the women. An additional 7.9% of the men and 5.5% of the women are full-time students who are out of the labor force. Thus, a total of 99.4% of the men and 92.9% of the women are either in the labor force or are full-time students pursuing graduate study (Table 2.6), and these proportions are very similar to those for graduates at the bachelor's level (Table 2.1).

A significant fraction of these master's graduates who are employed are working part-time - 11.1% of men and 22% of women (Table 2.9), with the proportions of both men and women working part-time being significantly higher in psychology. This field, together with agriculture, also has the highest proportion of male part-time workers seeking full-time employment. For women, mathematics is the leading field of part-time employment where full-time employment is sought, and psychology follows next.

As is true for the bachelor's graduates, there is positive correlation for women who are out of the labor force with student status, but a questionable relationship with high proportion of women among graduates in a field, higher than average unemployment rates in a field, and a lower than average correlation between field of degree and

TABLE 2.6

SOME CHARACTERISTICS OF MASTER'S GRADUATES OF 1974 AND 1975 IN 1976

	Total	PERCENT					
					Out of the Labor Force		
		By Sex	By Field	In Labor Force	Full time Student	Part time Student	Non-Student
TOTAL ALL FIELDS							
Men	87,047	80.3	100.0	91.5	7.9	0.1	0.5
Women	21,413	19.7	100.0	87.5	5.5	2.5	4.5
PHYSICAL SCIENCE							
Men	8,647	86.1	9.9	80.9	19.1	0.0	0.0
Women	1,398	13.9	6.5	82.0	9.0	0.0	9.0
MATHEMATICS							
Men	6,967	75.9	8.0	89.6	9.0	0.0	1.5
Women	2,211	24.1	10.3	78.8	0.0	10.6	10.6
COMPUTER SCI.							
Men	3,855	84.2	4.4	95.7	4.3	0.0	0.0
Women	721	15.8	3.4	88.6	0.0	0.0	11.4
ENVIRON. SCI.							
Men	1,515	81.0	1.7	89.6	10.5	0.0	0.0
Women	355	19.0	1.7	100.0	0.0	0.0	0.0
ENGINEERING							
Men	30,045	96.1	34.5	97.2	2.1	0.3	0.4
Women	1,211	3.9	5.6	91.4	8.7	0.0	0.0
BIOLOGY							
Men	9,800	69.9	11.3	89.2	9.6	0.0	1.2
Women	4,212	30.1	19.7	88.6	8.6	0.0	2.9
AGRICULTURE							
Men	4,482	86.0	5.1	88.2	9.8	0.0	2.0
Women	729	14.0	3.4	100.0	0.0	0.0	0.0
PSYCHOLOGY							
Men	8,407	61.3	9.7	88.8	11.2	0.0	0.0
Women	5,313	38.7	24.8	91.2	4.5	2.1	2.1
SOCIAL SCI.							
Men	13,329	71.7	15.3	89.8	10.2	0.0	0.0
Women	5,263	28.3	24.6	84.4	6.5	3.8	5.7

SOURCE: National Science Foundation, New Entrants Survey, 1976

field of employment.

The social sciences correlate positively with all of these factors - a below average labor force participation rate is accompanied by a higher than average proportion of women who are non-employed full-time students; a high proportion of women among the graduates; a high unemployment rate; and a higher than average proportion employed outside the degree field.

However, there are exceptions. Mathematics shows a lower than average participation in the labor force for women, but no full-time students among those who are out of the labor force. Psychology, which includes a high proportion of women, also shows a higher than average labor force participation rate. The unemployment rate for women in the physical sciences is zero, but 9% of the women in these fields are neither students nor in the labor force. Despite a 9.5% unemployment rate among women in engineering, none are out of the labor force who are not full-time students. Among computer scientists, three-fourths are employed in their degree field, but 11.5% are non-students out of the labor force.

Statistics from the Labor Department and elsewhere indicate that the higher the educational level, the higher the labor force participation among women. Among all women 20 to 24 who had completed four years of college in 1977, 86.2% were in the labor force. Among those with five or more years of college, 79.1% were in the labor force. Among women in the 25 to 34 age group, 69.8% with four years and 77.9% with five or more years of college are in the labor force (Table 1.3).

Women trained in the sciences are probably more likely than all women graduates to pursue graduate training. Thus, their total labor force participation rates of 83.6% for bachelor's graduates and 87.5% for master's graduates who are about 23 to 26 years old appears at least to equal and probably to exceed the national figures.

Student Status

When full-time, non-employed students are added to the number in the labor force, we find the same 93% of all women graduates at both the bachelor's and master's level who are either full-time students or are in the labor force. Considering part-time as well as full-time students, only 4.5% of women with master's degrees who are not students are out of the labor force, compared with 5.6% of the women with bachelor's degrees who are in this category. Among men, 1.6% of the bachelor's graduates and 0.5% of the master's are non-students who are out of the labor force (Tables 2.1 and 2.6).

Table 2.7 summarizes 1976 employment status by student status for these 1974 and 1975 master's graduates. Almost a fifth of both men and women are continuing their graduate study full-time, and more than 30% of both men and women are either full-time or part-time students, with a slightly higher proportion of women than of men in student status. These students, too, are typically employed - 66.5% of the men and 62% of the women are employed either full or part-time, with the larger proportion of men employed full-time and the women employed part-time. Among part-time students of both sexes who are not employed, almost two in ten of the women and three in ten of the men are seeking employment.

The proportion of all bachelor's graduates who began graduate study immediately after the bachelor's degree was about 23% of women and 27% of the men in 1976, based on the number of degrees granted in 1975 and first year graduate enrollments in 1976. Thus, science and engineering graduates of both sexes are entering graduate study in higher proportions than are graduates in all fields combined.

Among all the science and engineering graduates of 1974 and 1975, with bachelor's and master's levels combined, 38.2% of the men and 35.6% of the women were students in 1976, either full or part-time. Women who do not expect or intend to pursue a career are less likely to devote themselves to graduate study, so the similar proportions of men and women involved in graduate work indicates a probable commitment to the labor force by most of these women.

Unemployment Rates

Among master's graduates, 3.8% of men and 6.2% of women report that they are unemployed and seeking employment (Table 2.8). The unemployment rate for women is 7.1% compared to 4.2% for men (Table 2.9). This difference results from the inclusion in the first figure of individuals who are neither employed nor seeking employment.

TABLE 2.7

STUDENT AND EMPLOYMENT STATUS OF 1974 AND 1975 MASTER'S GRADUATES IN 1976 BY SEX

STUDENT STATUS & SEX	TOTAL STATUS KNOWN			EMPLOYMENT STATUS											
				EMPLOYED FULL TIME			EMPLOYED PART TIME			NOT EMPLOYED NOT SEEKING			UNEMPLOYED & SEEKING		
	No.	H%	V%	No.	H%	V%	No.	H%	V%	No.	H%	V%	No.	H%	V%
TOTAL															
Men	85,689	100.0	100.0	66,867	78.0	100.0	8,300	9.7	100.0	7,266	8.5	100.0	3,257	3.8	100.0
Women	20,868	100.0	100.0	13,228	63.4	100.0	3,734	17.9	100.0	2,618	12.5	100.0	1,288	6.2	100.0
Full Time Student															
Men	16,861	100.0	19.7	3,403	20.2	5.1	5,230	31.0	63.0	6,755	40.1	93.0	654	3.9	20.1
Women	3,725	100.0	17.9	524	14.1	4.0	1,748	46.9	46.8	1,141	30.6	43.6	87	2.3	6.8
Part Time Student															
Men	9,395	100.0	10.9	7,561	80.5	11.3	1,259	13.4	15.2	105	1.1	1.4	282	3.0	8.7
Women	2,939	100.0	14.1	1,301	44.3	9.8	561	19.1	15.0	529	18.0	20.2	548	18.6	42.5
Total Students															
Men	26,256	100.0	30.6	10,964	41.8	16.4	6,489	24.7	78.2	6,860	26.1	94.4	936	3.6	28.7
Women	6,664	100.0	31.9	1,825	27.4	13.8	2,309	34.6	61.8	1,670	25.1	63.8	635	9.5	49.3
Non-Students															
Men	60,792	100.0	70.9	55,903	92.0	83.6	1,540	2.5	18.6	406	0.7	5.6	2,321	3.8	71.3
Women	6,989	100.0	33.5	5,545	79.3	41.9	1,424	20.4	38.1	949	13.6	36.2	653	9.3	50.7

SOURCE: National Science Foundation, New Entrants Survey, 1976

TABLE 2.8
STATUS OF 1974 AND 1975 MASTER'S DEGREE GRADUATES WHO WERE NOT EMPLOYED IN 1976

		NOT EMPLOYED					
			SEEKING	NOT SEEKING			
	Total Empl. Status Known	Total Not Employed	Seeking Empl.	Not Seeking Total	Full-Time Student	Part Time Student	Not Students
TOTAL ALL FIELDS	106,558	14,429	4,545	9,884	7,896	633	1,355
Men	85,689	10,523	3,257	7,266	6,755	105	406
Women	20,868	3,906	1,288	2,618	1,141	529	949
PHYSICAL SCIENCE	9,654	2,158	327	1,831	1,705	0	126
Men	8,256	1,907	327	1,580	1,580	0	0
Women	1,398	251	0	251	126	0	126
CHEMISTRY	3,953	572	126	446	320	0	126
Men	2,997	320	126	194	194	0	0
Women	956	251	0	251	126	0	126
PHYSICS	3,110	1,218	128	1,090	1,090	0	0
Men	3,110	1,218	128	1,090	1,090	0	0
Women	0	0	0	0	0	0	0
OTHER PHYS.	2,591	369	73	296	296	0	0
Men	2,149	369	73	296	296	0	0
Women	442	0	0	0	0	0	0
MATHEMATICS	9,068	2,212	1,040	1,172	626	223	323
Men	6,967	1,655	928	727	626	0	101
Women	2,100	556	111	445	0	223	223
COMPUTER SCIENCE	4,576	349	103	246	164	0	82
Men	3,855	267	103	164	164	0	0
Women	721	82	0	82	0	0	82
ENVIRON. SCIENCE	1,819	205	52	153	153	0	0
Men	1,463	205	52	153	153	0	0
Women	355	0	0	0	0	0	0
ENGINEERING	31,052	1,554	623	931	722	105	105
Men	29,841	1,344	518	826	617	105	105
Women	1,211	210	105	105	105	0	0
BIOLOGY	13,442	1,707	227	1,480	1,252	0	228
Men	9,458	1,139	114	1,025	911	0	114
Women	3,984	569	114	455	341	0	114
AGRICULTURE	5,038	683	173	510	423	0	87
Men	4,309	597	87	510	423	0	87
Women	729	87	87	0	0	0	0
PSYCHOLOGY	13,609	1,956	555	1,401	1,179	111	111
Men	8,407	1,165	222	943	943	0	0
Women	5,202	791	333	458	236	111	111
SOCIAL SCIENCE	18,300	3,606	1,446	2,160	1,672	195	293
Men	13,133	2,245	907	1,338	1,338	0	0
Women	5,168	1,361	539	822	334	195	293
ECONOMICS	4,279	805	0	805	610	195	0
Men	3,694	610	0	610	610	0	0
Women	585	195	0	195	0	195	0
SOC/ANTHRO	6,187	1,810	757	1,053	860	0	193
Men	3,658	1,142	616	526	526	0	0
Women	2,529	667	141	526	334	0	193
OTHER SOC. SCI.	7,834	990	688	302	202	0	101
Men	5,780	493	291	202	202	0	0
Women	2,054	499	398	101	0	0	101

SOURCE: National Science Foundation, New Entrants Survey, 1976

EMPLOYMENT STATUS OF 1974 AND 1975 MASTER'S GRADUATES WHO WERE IN THE LABOR FORCE IN 1976, BY FIELD AND SEX

					EMPLOYED						
						PART TIME				NON-S/E	
								% Seeks F.T.			
	Total Empl. Status Known	Total Labor Force	% In Labor Force	Unem-ploymt Rate	Total Empl.	No.	% of Total	All P.T.	Non Student	% of F.T.	% No. S/E Available
TOTAL ALL FIELDS											
Men	85,689	78,424	91.5	4.2	75,167	8,300	11.1	17.7	72.2	20.1	17.2
Women	20,868	18,250	87.5	7.1	16,962	3,734	22.0	11.0	13.2	37.5	25.6
PHYSICAL SCI.											
Men	8,256	6,676	80.9	4.9	6,349	934	15.1	12.1	100.0	33.3	49.1
Women	1,398	1,146	82.0	0.0	1,146	73	6.4	100.0	100.0	26.0	-
MATHEMATICS											
Men	6,967	6,241	68.8	14.9	5,313	1,061	20.0	9.5	50.0	39.9	-
Women	2,100	1,654	78.8	6.7	1,543	313	21.6	32.3	100.0	50.0	-
COMPUTER SCI.											
Men	3,855	3,690	95.7	2.8	3,587	82	2.9	0.0	0.0	14.7	33.3
Women	721	639	88.6	0.0	639	0	0.0	0.0	0.0	25.7	100.0
ENVIRON. SCI.											
Men	1,463	1,311	89.6	4.0	1,259	200	16.1	0.0	0.0	9.5	-
Women	355	356	100.0	0.0	356	99	32.3	0.0	0.0	40.6	-
ENGINEERING											
Men	29,841	29,015	97.2	1.8	28,497	1,316	4.7	0.0	0.0	6.8	32.4
Women	1,211	1,107	91.4	9.5	1,002	99	10.4	0.0	0.0	11.0	-
BIOLOGY											
Men	9,458	8,434	89.2	1.4	8,320	1,368	16.6	8.3	100.0	27.9	33.3
Women	3,984	3,529	70.0	3.2	3,415	341	10.5	0.0	0.0	25.9	-
AGRICULTURE											
Men	4,309	3,799	88.2	2.3	3,712	469	12.9	65.2	0.0	17.5	68.2
Women	729	729	100.0	11.9	642	173	29.0	0.0	0.0	48.8	100.0
PSYCHOLOGY											
Men	8,407	7,463	88.8	3.0	7,241	1,720	24.2	34.7	61.0	14.8	-
Women	5,202	4,745	91.2	7.0	4,412	1,776	40.8	13.3	0.0	49.5	38.1
SOCIAL SCI.											
Men	13,133	11,795	89.5	7.7	10,888	1,149	10.9	21.1	100.0	42.6	16.5
Women	5,168	4,364	84.4	12.4	3,807	860	22.9	0.0	0.0	46.2	22.5

SOURCE: National Science Foundation, New Entrants Survey, 1976

When student status is considered together with job seeking (Table 2.7) we find that 9.3% of non-student women are unemployed and seeking employment compared to 3.8% of men. Among part-time students, 18.6% of women and 3.0% of men are unemployed and seeking work.

The unemployment rates are highest for men in mathematics, where an astonishing 15% of the labor force report that they are unemployed and seeking. For women the highest unemployment rate is in the social sciences, followed closely by agriculture. Also above the average unemployment rate for women is a 9.5% unemployment rate in engineering. This unexpected finding of over-average unemployment among women engineers also appears at the bachelor's level. Based on the low unemployment rate in engineering for men at both degree levels, and the consistent reports from the College Placement Council and others that employers have avidly sought more women engineers than are available for employment, this high unemployment rate is difficult to understand. Perhaps this phenomenon is related to the small number of women engineers in the sample population for this survey which produces a higher sampling error. However, we also found higher than average unemployment rates among women engineers in other data sets used for this study, (see page 38), and must conclude that the finding is probably significant.

Women graduates in the social sciences make up a fourth of all the women science and engineering graduates at the master's level. A closer examination of some of the internal fields of the social sciences finds a zero unemployment rate among women with master's degrees in economics, 7.0% in sociology-anthropology and 20.4% in "other social sciences." Since women in the social sciences, with a 12.4% unemployment rate, are one-fourth of all the women master's graduates, while men with master's in mathematics where the unemployment rate is 14.9% make up only 8.1% of all the men with new master's degrees, the relative influence of these two fields on the unemployment rates of the total group is readily perceived.

While the unemployment rate of women in mathematics is 6.7%, compared to 14.9% for men, we find that 20% of the employed women mathematicians are employed only part-time and almost a third of them are seeking full-time employment. Among men, almost 20% of those employed are part-time workers, and 9.5% seek full-time employment. Further, 40% of the men and half of the women with master's degrees in mathematics who are employed full-time are working outside of science and engineering. Job opportunities for mathematicians at the master's level appear to be poor.

Among women master's graduates, higher than average unemployment rates for women correlate positively with a higher than average proportion of non-student women out of the labor force only in the social sciences. At the bachelor's level, this relationship occurs in every field except biology and agriculture which have a higher than average unemployment rate but a slightly smaller proportion of non-students who are out of the labor force.

Field of Employment

At the master's level, higher proportions of employed graduates of both sexes and in all fields are working in the field of their major or one that is closely related than is true at the bachelor's level. Tables 2.5 and 2.10 show the field of employment by field of major for bachelor's and master's graduates respectively.

At both degree levels and for both sexes, the highest proportions of graduates employed in their major field are in engineering and computer sciences. Except for women in chemistry, no other fields at the bachelor's level show as many as half of the employed graduates working in the field of their major. At the master's level, only the "other social sciences", "other physical sciences", and mathematics show less than 50% field related employment, except for women in agriculture and the environmental sciences.

In economics, the master's degree appears to be a vital ingredient to field-related employment for women since all those at the master's level but only 6.4% of those at the bachelor's level are employed in any science or related field. To a lesser degree, this is true for all fields except engineering. The computer sciences show an opposite effect for women, with only 10.5% of the employed bachelor's graduates but 25.6% of the master's graduates working outside of science and engineering. Since

TABLE 2.10

FIELD OF DEGREE BY FIELD OF EMPLOYMENT OF 1974 AND 1975 MASTER'S GRADUATES IN 1976, BY SEX (PERCENT)

		FIELD OF EMPLOYMENT													
FIELD OF DEGREE	Total Employed	Chem.	Phys.	Other Phys. Sci.	Math	Compu. Sci.	Environ. Sci.	Engrg.	Bio.	Agric.	Psy.	Econ.	Soc/ Anthro.	Other Soc. Sci.	Other Fields
M	2,867	57.9	-	-	-	-	4.4	6.6	11.0	-	-	-	-	-	20.1
Chem. W	705	54.6	-	9.2	-	-	-	-	17.9	-	-	-	-	-	18.3
M	1,893	-	50.8	-	-	6.0	-	24.6	-	-	-	-	-	-	18.6
Phys. W	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other M	1,780	4.1	-	12.5	-	-	8.4	4.1	-	-	-	-	-	8.2	62.6
Phys. W	292	-	-	25.0	-	-	-	-	50.0	-	-	-	-	-	25.0
M	5,312	-	-	-	34.2	16.0	-	12.2	-	-	-	1.9	-	-	35.7
Math W	1,655	-	-	-	37.2	18.9	-	6.7	-	-	-	-	-	-	37.2
Compu M	3,587	-	-	-	-	61.0	2.9	21.8	-	-	-	-	-	-	14.3
Sci. W	639	-	-	-	12.8	61.3	-	-	-	-	-	-	-	-	25.6
Envir. M	1,209	-	4.1	4.3	-	-	58.1	12.5	8.6	4.1	-	-	-	-	8.3
Sci. W	251	20.7	-	-	-	-	-	19.5	60.2	-	-	-	-	-	41.4
M	28,293	-	0.7	0.4	0.7	5.0	1.4	83.4	0.7	-	-	-	-	0.7	6.9
Engrg. W	902	-	-	-	-	11.0	11.0	55.5	11.6	-	-	-	-	-	11.0
M	8,434	1.4	-	-	-	-	4.0	1.4	63.5	4.0	1.4	-	-	1.4	23.0
Biol. W	3,530	-	-	-	-	-	3.2	-	74.2	-	-	-	-	3.2	19.3
M	3,885	-	-	-	-	-	-	-	14.8	55.8	-	14.8	-	-	14.6
Agri. W	500	-	-	-	-	-	-	-	65.2	17.4	-	-	-	-	45.8
M	7,131	-	-	-	-	-	-	1.6	-	1.8	82.1	-	-	1.6	13.0
Psy. W	4,189	-	-	-	-	2.7	-	-	-	-	57.3	3.0	-	3.0	34.1
M	3,084	-	-	-	-	-	-	11.3	-	-	-	46.4	-	4.9	37.4
Econ W	390	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-
Soc/ M	2,374	-	-	5.9	-	-	-	-	8.1	-	8.1	-	51.9	5.9	20.0
Anthro W	1,861	-	-	-	-	-	-	-	-	-	-	-	53.8	10.4	35.9
Other M	5,187	-	-	-	-	-	1.8	1.8	-	-	-	-	-	45.9	50.5
Soc. W	1,461	-	-	-	-	-	-	-	-	-	-	-	-	45.9	54.0

SOURCE: National Science Foundation, New Entrants Survey, 1976

all of the women master's graduates who are employed outside of science and engineering fields gave the reason that no science and engineering jobs were available, we might conclude that demand for the master's degree in this field is weaker than for the bachelor's.

Among men in computer sciences, 11.2% of bachelor's level graduates and 14.3% of master's level were employed outside of science and engineering, and a third of the master's graduates indicated that no science and engineering jobs were available.

In biology, about half of the bachelor's graduates of both sexes were employed outside of science and engineering (with about half of these indicating no science and engineering job was available); and at the master's level only about a fifth were employed outside of science and engineering while a third of the men and none of the women said they could not find science and engineering jobs.

In general, the proportions of both sexes who were employed outside of science and engineering were similar, except for master's level environmental scientists and agriculture majors at both degree levels. The wide disparity between the sexes in total non-science and engineering employment is more field-related than sex-related.

Summary of Findings

Student status is the single most important element related to being out of the labor force for both men and women among these recent graduates. Full-time students out of the labor force plus persons in the labor force account for 99.5% of men graduates at the master's level and 92.9% of women.

Although the master's degree is often taken as a terminal degree, 30.6% of the men and 31.9% of the women master's graduates in this two-year combined group report that they are students. Among men, 19.6% are full-time and 11.0% part-time students while the proportions for women are 17.9% and 14.0% respectively.

As with the baccalaureate graduates, a substantial number of the full-time graduate students also report full-time employment. Among the men, 20.2% of all full-time students are also employed full-time while 14.1% of full-time student women also report full-time employment.

Among women master's graduates, only 12.5% are neither employed nor seeking employment. Within this group, 43.6% are full-time graduate students, 20.2% are part-time graduate students and the remaining 36.2% are out of the labor force for other reasons. Among men, only 8.5% of the graduates are neither employed nor seeking employment with 93% of these being full-time students, 1.4% part-time students and 5.6% out of the labor force for all other reasons.

Both men and women at the master's level are much more likely to be employed in their field of major or a closely related field than are bachelor's level graduates, except in engineering, physical sciences and computer sciences where the proportions are similar. Graduates in the social sciences (except economics) are less likely than graduates in any other fields to be working in any science or engineering field.

The unemployment rate for women is 7.1% compared to 4.2% for men. Field of major is the more important determinant of unemployment rates, and women have higher unemployment rates than men because more of them are concentrated in the high unemployment fields - principally the social sciences and mathematics.

Conclusions

Among both bachelor's and master's graduates of 1974 and 1975 who were surveyed one and two years after receipt of the degree, less than 15% were out of the labor force. For both men and women, the majority of individuals who were out of the labor force were full-time graduate students. At both degree levels, 93% of the women were either in the labor force or were full-time graduate students who were not employed. While there were differences by field, the variation at the bachelor's level was small ranging from 92.4% of the women in the social sciences to 97.8% of the graduates in computer sciences who were either in the labor force or were non-employed full-time graduate students. At the master's level, the variation ranges from 78.6% of the women graduates in biology to 100% of those in engineering, environmental sciences and agriculture.

Typically, the women in this survey are in the 23 to 26 year age range. We have no information as to their marital or parental status, but it seems unlikely that the number who have small children is confined to that approximately 5% who are non-students out of the labor force. Other data examined for this study indicate a high incidence of labor force participation, even among mothers of pre-school children.

About half of all full-time students (48.1% of bachelor's graduates and 54.3% of master's graduates) are also employed - indeed one-fourth of the full-time students who are baccalaureate graduates and 20% of full-time students at the master's level report full-time employment.

The high rate of combined labor force participation and full-time graduate study without other employment among the women from these recent graduating classes indicates a strong attachment to the labor force at a time when many of them may have young children. It may also indicate that significant portions of the group are postponing childbearing.

Among all scientists and engineers in this data set who are unemployed and seeking work, 36% at the bachelor's level and 28% at the master's level are women, but women make up only 31% of the bachelor's graduates and 20% of the master's graduates whose employment status is known. Most of this difference lies in the field choices of women, who are concentrated in the fields with the highest unemployment rates. This factor probably adds discouraged women to the small number who are out of the labor force without being full-time students. Other segments of this study also support this premise.

Nonetheless, the participation in the labor force among these recently graduated women who are not out of the labor force because they are full-time graduate students is 92.5% among both bachelor's and master's graduates. For men the participation rate is 97.6% for bachelor's graduates who are not full-time students outside the labor force, and 99.3% among master's graduates.

Over the next few years, some of these women will take breaks in their employment for a few months or a few years to devote themselves to their families. Others will continue working full-time or part-time even when they have small children. Their present participation in the labor force coupled with the high proportion who are pursuing graduate education indicates that most of these women plan to continue to be a part of the U.S. labor force, with or without breaks for childrearing. Approximately the same proportions of men and women are presently pursuing graduate degrees. This added training will increase even further the likelihood of labor force participation by the women.

Recent master's graduates are considerably more likely than bachelor's graduates to be employed in the field of their major or one closely related to it. For example, 43% of women biology graduates in the bachelor's group are employed in biology compared to 74.2% of the master's graduates. In psychology, the proportions are 14.8% of bachelor's and 57.3% of master's graduates. This is true for men as well as women.

The unemployment rates among master's graduates also are generally lower than for bachelor's graduates, and considerably lower for both men and women in biology and psychology. In the social sciences, the unemployment rate for men drops from 11.2% at the bachelor's level to 7.7% at the master's, but for women the 11.5% rate for bachelor's increases to 12.4% for master's graduates. This is the major reason why the unemployment rate for all men in the sample drops from 8.1% for bachelor's graduates to 4.2% for master's while for women the unemployment rates are 10.6% at the bachelor's and 7.1% at the master's level.

About a fourth of both men and women bachelor's graduates who are full-time students and a fifth of master's graduates who are full-time students are also employed full-time, with additional proportions in both groups employed part-time. Among part-time students, more than three-quarters of both sexes are also employed.

This study reveals that among recent graduates, the most important dissimilarity between men and women in terms of their present and future labor force participation is the field concentration. Considerably higher proportions of men than women at both the bachelor's and master's level have majored in engineering where the employment opportunities have been good. Two-thirds of the women at the bachelor's level and half at the master's level have majored in the social sciences and psychology. Among the men, one-third at the bachelor's level and one-fourth at the master's level are in these fields. Based on unemployment rates, these fields offer less opportunity than most of the others.

Further, within the social sciences, a higher proportion of the men have chosen the field of economics where the opportunities also appear to be better. Only 6.6% of the women bachelor's graduates in the social sciences majored in economics compared to 13.3% of the men. At the master's level, 11.1% of the women social science majors and 27.7% of the men are in economics.

Occasional differences between the sexes in unemployment rates for the same field generally do not appear to be significant. One exception is engineering where, despite a good job market and a reputed demand for women, the unemployment rate for these recent women graduates in engineering is extraordinarily high - 10% at the bachelor's level and 9.5% at the master's level. We have found no explanation for this wide divergence in unemployment rates between men and women. A similar divergence exists in agriculture where the unemployment rates for women are 14.5% at the bachelor's level and 11.9% at the master's compared to 5% and 2.3% respectively for men. Because of the relatively small numbers of women in these two fields, the sample size may introduce disproportionate error in the data for these fields. However, we found the same divergence in engineering and agriculture in other segments of this study, and may reasonably conclude that the figures have credence.

The overall conclusion to be reached from the information in this survey is that recent graduates in science and engineering of both sexes are generally either in the labor force or are full-time graduate students improving their credentials to enter that labor force.

CHAPTER 3

1978 SURVEY OF SCIENCE AND ENGINEERING GRADUATES OF 1972 AND 1976

In 1978, the National Science Foundation surveyed a sample of the science and engineering bachelor's and master's graduates of 1972 and 1976, thus providing information on recent graduates as well as those who were about four years older. Because the present study was begun just prior to this survey, the NSF added to its questionnaire a question regarding the parental status of these graduates.

1972 Graduates

Graduate Education

TABLE 3.1

NUMBER AND HIGHEST DEGREE IN 1978 OF BACHELOR'S AND MASTER'S GRADUATES OF 1972 BY FIELD, SEX AND 1972 DEGREE LEVEL

FIELD OF DEGREE & 1972 DEGREE LEVEL	Total	Women	% Women	HIGHEST DEGREE IN 1978 (% OF TOTAL)					
				BACHELOR'S		MASTER'S		DOCTORATE	
				Men	Women	Men	Women	Men	Women
All Fields									
Bachelor's	317,847	90,025	28.3	69.6	69.3	21.8	26.6	8.6	4.1
Master's	58,167	10,598	18.2			76.9	80.9	23.1	19.1
Phys. Science									
Bachelor's	16,737	2,643	15.8	57.2	63.8	24.4	24.0	18.4	12.2
Master's	4,827	670	13.9			63.6	65.2	36.4	34.8
Math. Sci.									
Bachelor's	23,848	9,323	39.1	58.4	72.4	36.1	26.3	5.5	1.3
Master's	5,209	1,552	29.8			78.3	83.6	21.6	16.3
Computer Sci.									
Bachelor's	3,402	340	10.0	85.2	83.2	9.2	16.8	5.6	-
Master's	1,977	201	10.2			93.6	100.0	6.5	
Environ. Sci.									
Bachelor's	8,489	1,419	16.7	75.3	73.2	22.8	18.6	1.9	8.2
Master's	2,260	241	10.7			80.0	81.7	20.0	18.3
Engineer									
Bachelor's	51,774	618	1.2	75.4	69.1	22.5	30.9	2.2	-
Master's	17,039	345	2.0			89.9	83.5	10.1	16.5
Biol. Sci.									
Bachelor's	40,996	11,967	29.2	61.4	62.4	16.4	25.6	22.2	12.0
Master's	6,634	2,149	32.4			69.2	80.6	30.8	19.4
Agric. Sci.									
Bachelor's	13,560	740	5.4	85.9	88.0	11.7	8.0	2.3	4.1
Master's	2,691	190	7.1			82.0	92.6	18.0	7.4
Psychology									
Bachelor's	43,421	20,154	46.4	55.4	65.7	30.2	30.9	14.4	3.4
Master's	5,293	2,033	38.4			44.9	68.2	55.1	31.8
Soc. Sci.									
Bachelor's	115,619	42,821	37.0	74.0	72.0	19.6	25.7	6.5	2.3
Master's	12,238	3,218	26.3			68.5	88.7	31.5	11.3

Data Source: National Science Foundation, New Entrants Survey, 1978

Table 3.1 shows the total number, percent by sex, and highest degree level attained in 1978 by the bachelor's and master's graduates of 1972.

Women earned 28.3% of the S/E bachelor's and 18.2% of the master's degrees in this 1972 class. Only in the biological sciences is the women's proportion of master's degrees higher than their proportion of bachelor's degrees.

When the graduates of 1972 who earned either a bachelor's or a master's in that year are combined, we find that in 1978, 11% of the men but only 5.7% of the women have earned a doctorate. In the combined sample, however, 32.3% of the women and 31.2% of the men report a master's as their highest degree in 1978.

Considering only the 1972 bachelor's graduates, 26.6% of the women and 21.8% of the men report a master's as their highest degree in 1978, but the proportion of both men and women who took at least one graduate degree is similar - 30.4% of the men and 30.7% of the women. The somewhat greater tendency of women to stop at the master's level is notable among both levels of 1972 graduates.

Labor Force Participation

In this data sample, as in all the other data sets we have examined, the women show strong adherence to the labor force, and that adherence increases with higher degree levels. Table 3.2 shows the proportion of men and women who are in the labor force; their unemployment rates; and the proportion who are out of the labor force for full-time graduate study and for all other reasons.

The proportion of women who are out of the labor force is higher in every instance than the proportion of men. The unemployment rate (the ratio of those seeking employment to the total labor force) also is higher for women than for men, being 3.5% and 1.6% among the bachelor's graduates of 1972; 4.0% and 1.1% among the master's graduates (and this holds true in almost every field).

Some of these men and women are out of the labor force because they are full-time students. Among the 1972 bachelor's graduates, 3.7% of the men and 2.6% of the women are full-time students out of the labor force, as are 1.6% of the male and 3.3%

TABLE 3.2

EMPLOYMENT STATUS OF 1972 S/E GRADUATES IN 1978, BY DEGREE LEVEL, SEX AND FIELD

FIELD & 1972 DEGREE LEVEL							OUT OF LABOR FORCE			
	TOTAL NUMBER		% IN LABOR FORCE		UNEMPLOYMENT RATE		% FULL-TIME STUDENTS		% OUT FOR OTHER REASONS	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
ALL FIELDS										
Bachelor's	227,822	90,025	94.8	79.9	1.6	3.5	3.7	2.6	1.4	17.5
Master's	47,569	10,598	97.4	86.5	1.1	4.0	1.6	3.3	1.0	10.2
PHYSICAL SCI.										
Bachelor's	14,094	2,643	92.6	85.1	2.1	2.7	5.6	2.9	1.8	12.0
Master's	4,156	670	98.1	83.6	0.9	0.0	1.7	-	0.2	16.4
MATH SCI.										
Bachelor's	14,525	9,323	95.4	76.9	1.3	-	3.4	1.3	1.2	21.8
Master's	3,657	1,552	96.3	89.8	2.3	2.3	2.2	2.1	1.5	8.1
COMPUTER SCI.										
Bachelor's	3,062	340	98.1	66.8	-	-	1.9	-	-	33.2
Master's	1,776	201	100.0	85.6	-	-	-	-	-	14.4
ENVIRON. SCI.										
Bachelor's	7,071	1,419	96.2	80.4	2.0	2.9	2.5	2.7	1.3	16.8
Master's	2,019	241	97.6	91.7	-	-	1.2	-	1.2	8.3
ENGINEERS										
Bachelor's	51,156	618	97.9	74.8	0.7	17.5	1.5	6.1	0.6	19.3
Master's	16,694	345	98.8	100.0	0.4	-	0.9	-	0.3	0.0
BIOLOGICAL SCI.										
Bachelor's	29,029	11,967	89.7	83.5	3.4	3.6	7.5	6.0	2.8	10.5
Master's	4,485	2,149	93.1	77.4	5.8	2.1	6.9	6.5	0.0	16.1
AGRIC. SCI.										
Bachelor's	12,820	740	97.7	76.1	1.0	5.3	1.8	8.0	0.5	16.1
Master's	2,501	190	97.6	78.9	0.5	9.3	0.5	7.4	1.9	14.2
PSYCHOLOGY										
Bachelor's	23,268	20,154	93.2	80.7	3.4	4.8	4.5	2.9	2.3	16.4
Master's	3,260	2,033	97.8	90.9	1.2	-	1.1	2.3	1.1	6.8
SOC. SCI.										
Bachelor's	72,798	42,821	94.8	79.1	1.2	3.4	3.6	1.6	1.6	19.3
Master's	9,020	3,218	96.5	87.6	0.6	10.1	1.0	3.6	2.5	8.8

Data Soarce: National Science Foundation, New Entrants Survey, 1978 of the female master's graduates of 1972. In addition, however, 17.5% of the 1972 bachelor's graduate women and 10.2% of the master's graduates are out of the labor force for other reasons, mostly concerned with family responsibilities.

The 1978 survey asked respondents if they had children, and if so if they had children under age 6 and/or over age 6. Among the 1972 women graduates, 18.7% of the bachelor's graduates and 15.6% of the master's graduates reported having children under age 6. Six percent of the bachelor's and 19.6% of the master's graduates reported children over six years of age in 1978. Obviously some women had children in both age groups.

Among the 18,469 women from the 1972 classes who had children under 6, 57.4% of the bachelor's graduates and 46.2% of the master's graduates were out of the labor force in 1978. However, among the 7,564 women who reported having children over six, only 7% of the bachelor's graduates and 13.7% of the master's graduates were out of the labor force in 1978.

Since two thirds of the women from these classes who are out of the labor force in 1978 and who were not full-time graduate students report children under age six, we can assume that a substantial proportion of them will return to the labor force when their children reach school age. The women graduates of 1972 in this sample are typically 28 to 31 years old, with 87% of all these graduates being in the 25-34 age group.

Examined in another way, we note that although 18.7% of the women from the 1972 bachelor's class report having children under age six, only 17.5% of the women in that class who are not full-time graduate students report being out of the labor force in 1978. Among the master's graduates of that year, 15.6% report children under age six, but only 10.2% of this class are out of the labor force for other than full-time graduate study. A further analysis of labor force participation of mothers begins on page 43.

As shown in Table 3.2, women whose bachelor's degrees are in the physical sciences and biosciences, are somewhat more likely to be in the labor force than are those whose degrees are in other fields. At the master's level, women who majored in psychology are the least likely to be out of the labor force. Whether this is related to job opportunities, we cannot tell.

As in all other data sources we have found, the 1978 unemployment rates for the women graduates of 1972 at both degree levels are more than twice as high as the unemployment rates for men, with the gap a little larger for the master's graduates than for the bachelor's graduates. The unemployment rate for men is highest in the biological sciences, and in psychology at the bachelor's level; while for women the unemployment rate is highest in engineering, agricultural sciences and psychology among the bachelor's graduates, and in agricultural sciences and social sciences among the master's graduates. The high unemployment rate in engineering reinforces the data from the 1976 survey of recent graduates. No clear relationship is apparent between unemployment rates for these women and the proportion who are out of the labor force, except that a lower than average rate of unemployment among the bachelor's graduates generally is matched by a higher labor force participation rate.

1976 Graduates

Table 3.3 shows the number and 1976 degree level by field and sex, and the 1978 degree level attained by these graduates. Women make up 32.5% of the bachelor's class of 1976 and 22.4% of the master's graduates. These women are remarkably close to the men in proportion of graduate degrees earned since 1976. From the bachelor's graduates, 12.5% of the women and 10.3% of the men have earned a master's degree, with a slight fraction of both sexes having achieved a doctorate by 1978. Among the 1976 master's graduates, 6.6% of the men and 6.2% of the women have achieved the doctorate.

The field variation is marked, with women well below men in the proportion earning graduate degrees in the physical sciences, mathematical sciences, environmental sciences and engineering, but proportionately ahead of the men in the agricultural sciences. Women from this class have earned more master's degrees in psychology, but fewer doctorates than have men.

TABLE 3.3

NUMBER AND HIGHEST DEGREE IN 1978 OF BACHELOR'S AND MASTERS GRADUATES OF 1976, BY FIELD, SEX AND 1976 DEGREE LEVEL

FIELD OF DEGREE & 1976 DEGREE LEVEL	Total	Women	% Women	HIGHEST DEGREE IN 1978 (% OF TOTAL)					
				BACHELOR'S		MASTER'S		DOCTORATE	
				Men	Women	Men	Women	Men	Women
All Fields									
Bachelor's	318,498	103,444	32.5	89.2	87.4	10.3	12.5	0.6	0.1
Master's	58,828	13,158	22.4			93.4	93.8	6.6	6.2
Phys. Science									
Bachelor's	16,329	3,137	19.2	85.0	87.6	14.6	11.3	0.4	1.1
Master's	3,773	535	14.2			90.3	97.0	9.7	3.0
Math. Sci.									
Bachelor's	16,084	6,554	40.7	80.2	86.7	19.8	13.3	-	-
Master's	3,863	1,313	34.0			96.2	93.9	3.7	6.1
Computer Sci.									
Bachelor's	5,664	1,124	19.8	90.0	94.1	10.0	5.9	-	-
Master's	2,603	377	14.5			93.5	84.9	6.5	15.1
Environ. Sci.									
Bachelor's	8,983	1,912	21.3	89.9	92.6	10.1	7.4		
Master's	2,381	415	17.4			94.4	97.8	5.6	2.2
Engineers									
Bachelor's	47,057	1,835	3.9	87.4	94.3	12.6	5.7	0.6	-
Master's	16,497	547	3.3			97.4	89.7	2.6	10.3
Biol. Sci.									
Bachelor's	59,012	20,298	34.4	91.4	91.7	6.5	7.9	2.1	0.4
Master's	6,939	2,193	31.6			91.2	96.6	8.8	3.4
Agric. Sci.									
Bachelor's	19,460	3,570	18.3	93.1	85.8	6.7	13.4	0.2	0.8
Master's	3,351	478	14.3			94.4	97.7	5.6	2.3
Psychology									
Bachelor's	50,364	27,376	54.4	85.9	80.9	13.7	19.1	0.4	-
Master's	7,859	3,671	46.7			80.8	87.5	19.2	12.5
Soc. Sci.									
Bachelor's	95,544	37,638	39.4	91.6	89.1	8.1	10.9	0.2	-
Master's	11,561	3,629	31.4			92.8	98.3	7.2	1.6

Data Source: National Science Foundation, New Entrants Survey, 1978

Labor Force Participation

Table 3.4 shows the 1978 labor force participation of these recent graduates. The proportion of men and of women who are in and out of the labor force is similar, and once again full-time graduate study is the most significant reason for being out of the labor force among both men and women. Only 6% of the women at the bachelor's level and 8% of the 1976 master's graduates are out of the labor force for all reasons other than full-time graduate study.

TABLE 3.4

EMPLOYMENT STATUS OF 1976 S/E GRADUATES IN 1978, BY 1976 DEGREE LEVEL, SEX & FIELD

FIELD & 1976 DEGREE LEVEL	TOTAL NUMBER		PERCENT							
			% IN LABOR FORCE		UNEMPLOYMENT RATE		FT STUDENTS OUTSIDE LF		NON-STUDENTS OUT OF LF	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
ALL FIELDS										
Bachelor's	215,054	103,444	87.5	84.3	3.0	5.8	11.4	10.0	1.1	5.6
Master's	45,670	13,158	91.0	87.2	2.7	5.4	7.7	4.8	1.3	8.0
PHYSICAL SCI.										
Bachelor's	13,192	3,137	74.7	72.0	3.0	6.0	20.0	24.5	5.3	3.5
Master's	3,238	535	83.3	97.0	1.6	0.0	15.9	0.0	0.8	3.0
MATH SCI.										
Bachelor's	9,531	6,554	86.1	91.5	3.6	2.0	12.3	3.6	1.6	4.9
Master's	2,550	1,313	86.9	93.9	4.3	4.4	10.3	2.1	2.8	4.0
COMPUTER SCI.										
Bachelor's	4,540	1,124	100.0	100.0	1.3	0.0	-	-	-	-
Master's	2,226	377	97.8	95.0	4.5	0.0	2.2	-	-	5.0
ENVIRON. SCI.										
Bachelor's	7,072	1,912	96.1	81.7	6.6	7.3	2.7	5.4	1.2	12.9
Master's	1,966	415	90.7	90.6	3.4	2.4	9.2	6.5	0.0	2.9
ENGINEERS										
Bachelor's	45,223	1,835	97.2	98.6	0.5	4.9	2.6	1.4	0.2	0.0
Master's	15,951	547	96.3	97.3	0.6	8.1	2.5	-	1.2	2.6
BIOLOGICAL SCI.										
Bachelor's	38,714	20,298	73.0	77.1	3.8	7.2	26.1	16.2	0.9	6.7
Master's	4,746	2,193	78.2	79.3	2.6	4.4	20.2	11.5	1.6	9.2
AGRIC. SCI.										
Bachelor's	15,890	3,570	95.4	93.7	1.9	4.2	3.4	4.0	1.2	2.3
Master's	2,873	478	94.4	85.8	2.5	11.2	5.6	9.6	0.0	4.6
PSYCHOLOGY										
Bachelor's	22,987	27,376	84.7	82.1	3.3	6.7	14.5	9.9	0.8	8.0
Master's	4,188	3,671	91.5	90.6	7.6	5.2	6.9	2.3	1.6	7.1
SOCIAL SCI.										
Bachelor's	57,907	37,638	89.7	87.8	4.6	5.5	8.4	8.1	1.9	4.1
Master's	7,932	3,629	89.3	81.9	4.3	7.5	8.7	5.5	2.0	12.5

Data Source: National Science Foundation, New Entrants Survey, 1978

Only 4.1% of the women bachelor's graduates of 1976 but 14.4% of the master's level graduate women report having children under age 6 in 1978. Less than 40% of mothers with pre-school children from the 1976 bachelor's class and only 31% of mothers from the master's 1976 graduates are out of the labor force.

The unemployment rates among these recent graduates are 3.0% and 5.8% respectively for men and women from the bachelor's class; 2.7% and 5.4% respectively from the master's class. The higher unemployment rate for women persists through most fields, and is markedly higher in engineering, biosciences, agricultural sciences and social sciences. In psychology, the unemployment rate for women at the bachelor's level is twice as high as for men, but it is slightly lower than the rate for men among the master's graduates.

As in the 1976 survey of the graduates of 1974 and 1975, (Chapter 2), higher unemployment rates for women appear positively related to the proportion who are out of the labor force, particularly among graduates in environmental sciences, psychology and social science.

Labor Force Participation of Mothers

Table 3.5 shows the employment status of mothers from both the 1972 and 1976 graduating classes, distinguishing between mothers whose children are pre-school age and mothers with children six and older. Some mothers, of course, fall in both groups.

A somewhat surprising 31% of the mothers of pre-school age children are employed full-time, with an additional 13% employed part-time and 4.3% seeking employment. Only about half of these mothers are out of the labor force. However, there is a distinct difference in labor force participation between mothers of pre-school children who graduated in 1972 and those who graduated in 1976, with 63% of those from the 1976 class and only 44% of those from the 1972 class being in the labor force. This difference exists no matter what the present degree level of the mother, perhaps indicating the rapid change that has taken place in recent years in increased labor force participation of mothers whose children are of pre-school age. Women who graduated in 1976 appear to have elected to remain in the labor force while their children were young to a much larger degree than those women who graduated four years earlier.

TABLE 3.5

EMPLOYMENT STATUS OF MOTHERS FROM 1972 AND 1976 BACHELOR'S AND MASTER'S GRADUATES, 1978, BY HIGHEST DEGREE IN 1978, GRADUATING CLASS, AND AGE GROUP OF CHILDREN

HIGHEST DEGREE IN 1978	CHILDREN UNDER SIX					CHILDREN SIX AND OVER				
	Number	Employed Full-Time	Employed Part-Time	Seeking	Out of Labor Force	Number	Employed Full-Time	Employed Part-Time	Seeking	Out of Labor Force
BACHELOR'S										
1976 Grads	4,210	38.9	12.5	8.0	40.6	7,040	59.2	7.4	9.4	24.1
1972 Grads	13,594	25.6	11.6	3.9	58.9	3,702	46.8	29.5	13.3	10.4
Combined	17,804	28.8	11.8	4.9	54.6	10,742	54.9	15.0	10.8	19.4
MASTER'S										
1976 Grads	1,906	38.3	21.0	9.7	31.0	3,675	72.7	10.8	9.1	7.4
1972 Grads	4,375	33.4	13.5	-	52.9	3,494	63.4	13.1	16.7	6.8
Combined	6,281	34.9	15.8	2.9	46.2	7,169	68.2	11.9	12.8	7.1
DOCTORATE										
1976 Grads.	86	66.3	33.7	-	-	57	50.9	50.9	-	-
1972 Grads	499	60.9	22.4	-	16.6	368	74.7	12.5	-	12.5
Combined	585	61.7	24.1	-	14.2	425	71.5	17.6	-	10.8
ALL DEGREE LEVELS										
1976 Grads	6,202	39.1	15.4	8.4	37.1	10,772	63.7	8.7	9.3	18.3
1972 Grads	18,468	28.4	12.3	2.8	56.4	7,564	55.8	21.1	14.2	8.9
Combined	24,670	31.1	13.1	4.2	51.5	18,336	60.4	13.8	11.3	14.4
ALL BACHELOR'S GRADUATES										
of 1976	4,310	40.3	12.2	7.8	39.7	8,119	61.8	6.7	10.6	20.9
of 1972	16,815	27.5	12.0	3.1	57.4	5,484	54.2	21.0	17.8	7.1
Combined	21,125	30.1	12.0	4.1	53.8	13,603	58.7	12.5	13.5	15.3
ALL MASTER'S GRADUATES										
of 1976	1,892	36.3	22.7	9.8	31.2	2,653	69.8	14.9	5.1	10.3
of 1972	1,654	38.3	15.5	-	46.2	2,080	60.1	21.4	4.9	13.7
Combined	3,546	37.3	19.3	5.2	38.2	4,733	65.5	17.8	4.9	11.8

SOURCE: National Science Foundation, New Entrants Survey, 1978

Labor force participation (both full-time and part-time employment) also increases with higher degree levels among the mothers of pre-schoolers, so that only 14.2% of the doctorates in this group are out of the labor force compared to 54.6% of the mothers of pre-school children where the mother's highest degree is a bachelor's

Among the mothers with children six and older, 83% are in the labor force. Even among mothers whose highest degree is the bachelor's degree, more than 80% were in the labor force in 1978

The largest difference between 1972 and 1976 graduates who have children 6 and over appears to be the high rate of part-time employment among the 1972 graduates (21.1%) and a lower rate of withdrawl from the labor force (8.9%), while fewer of the 1976 graduates are working part-time (8.7%) and more are out of the labor force (18.3%).

The most surprising finding in these data is that a higher number and proportion of women who earned a degree in 1976 than of those from the 1972 classes have children six and over. Among the 1976 graduates, 5.3% report having children under 6 and 9.2% report having children 6 and over. Among the graduates of 1972, a higher proportion report pre-school children (18.2%), as we would expect, but a lower proportion report having children six and over (7.4%) which is unexpected (Table 3.6).

TABLE 3.6

PROPORTION OF WOMEN GRADUATES OF 1972 AND 1976 WHO REPORT HAVING CHILDREN IN 1978, BY AGE GROUP OF CHILDREN

	Total Women	No. Reporting Children < 6	% of Total	No. Reporting Children 6 & Over	% of Total
1976 Graduates					
Bachelor's	103,444	4,310	4.2	8,119	7.8
Master's	13,158	1,892	14.4	2,653	20.2
1972 Graduates					
Bachelor's	90,025	16,815	18.7	5,484	6.1
Master's	10,598	1,654	15.6	2,080	19.6
TOTAL					
1976 Graduates	116,502	6,202	5.3	10,772	9.2
1972 Graduates	101,623	18,469	18.2	7,564	7.4

SOURCE: National Science Foundation, New Entrants Survey, 1978

The data suggest that this indicates a significant increase in the number of re-entry women who were among the bachelor's or master's graduates in 1976, following an earlier school or career interruption while their children were small. Among the 1976 bachelor's graduates in 1978, 60% are 24 or under in 1978, and 28% are 25-29.

An 80% labor force participation rate among these baccalaureate level mothers of older children when compared to the 45% participation rate of mothers of pre-schoolers reinforces the finding in other parts of this study that women trained in science and engineering want to and do return to the labor force when their children are in school, and that their participation is higher than among all college graduates.

In March 1974, only 43% of women with four or more years of college who had children under six years of age were participating in the labor force, according to the Labor Department.[1] Among women who had children only in the 6-17 age range, 62% were in the labor force in 1974.

Among all mothers of pre-school children in 1978, regardless of educational level, 42% were in the labor force, as were 57% of mothers with school age children.[2]

In this sample of women scientists and engineers, the labor force participation of mothers with pre-school children is somewhat higher than the 1974 national rate for college graduates, while the participation of those with children six and over is significantly higher than the 1974 data indicate for all college graduate mothers.

Among the mothers of older children, as well as the mothers of pre-schoolers in this 1978 survey, those women with a graduate degree in science or engineering are more likely than those with only a bachelor's degree to stay in or to return to the labor force.

In the sample of about 600 women chemistry and engineering graduates surveyed as another part of this study (Chapter 5), 35% of those graduates of the past 15 years were mothers, and 64% of those mothers were in the labor force. Among mothers whose children were under age six, 62% were in the labor force. This rate appears to be related more to the high incidence of graduate degrees among the chemistry graduates and the excellent job opportunities for the engineering baccalaureates than to other commonalities among women science and engineering graduates.

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[1] Handbook on Women Workers, U.S. Department of Labor, Women's Bureau, Bulletin 297, p. 23

[2] "Changes in Marital and Family Characteristics of Workers, 1970-78," by Beverly L. Johnson, Monthly Labor Review, April 1979

Salaries

We can examine the salaries of the graduates of both the 1972 and 1976 classes who were employed full-time in science and engineering in 1978. In Table 3.7, we find a fairly universal pattern of salary differentials between men and women in each working field, differentiated by the two graduating levels for both 1972 and 1976.

TABLE 3.7

1978

MEDIAN ANNUAL SALARIES OF BACH. & MASTER'S GRADS OF 1972 & 1976 WHO ARE EMPLOYED FULL-TIME IN SCIENCE OR ENGINEERING, BY FIELD OF WORK & SEX

FIELD OF WORK	BACH. GRADS OF 1972		MASTER'S GRADS OF 1972		BACH. GRADS OF 1976		MASTER'S GRADS OF 1976	
	Men	Women	Men	Women	Men	Women	Men	Women
ALL FIELDS	19,644	15,225	22,865	18,115	15,598	12,092	19,074	15,010
PHYS. SCI.	16,917	18,200•	20,315	17,324	14,077	13,111	18,343	13,776
Chemists	16,341	18,200•	20,721	17,507	14,206	13,079	18,460	13,741
Phys/Astr.	18,520	-	20,185	16,600	12,088	16,632•	18,721	16,200
Other P/S	21,846	18,200	20,305	-	13,899	12,931	15,339	13,000
MATH SCI.	15,141	14,297	18,301	19,000•	14,794	13,000	14,967	16,151•
COMPUTER SPEC.	20,001	16,208	22,290	20,410	16,383	16,013	20,013	17,805
ENVIRON. SCI.	20,116	18,043	23,788	15,855	13,725	13,571	20,392	15,060
Earth	20,283	18,108	25,663	15,903	14,930	18,008•	21,783	15,110
Other	18,853	16,350	17,819	14,746	12,008	13,400•	12,071	15,000•
ENGINEERS	20,348	18,206	25,044	22,468	17,210	16,171	21,094	19,902
Chemical	22,125	24,150•	24,288	27,200•	19,017	19,289•	22,203	19,800
Civil	19,513	19,600•	24,361	29,867•	16,459	17,400•	20,314	17,000
Elec.	22,089	18,400	25,188	19,117	18,088	14,697	20,947	18,200
Mech.	20,897	15,800	24,671	22,083	18,052	14,965	21,850	24,462•
LIFE SCI.	15,453	12,666	17,873	14,922	11,217	10,265	14,642	13,180
Biol.	15,088	12,603	16,967	14,869	10,291	10,294•	14,479	13,355
Agric.	16,689	18,164•	20,086	15,000	12,140	10,157	14,851	12,700
PSYCHOLOGISTS	16,319	14,108	18,625	18,038	10,144	10,972•	13,499	14,402•
SOCIAL SCI.	18,007	16,262	19,494	16,342	12,922	11,044	16,174	14,803
Economists	18,116	16,359	21,700	29,761•	15,050	16,950•	16,320	15,100
Soc/Anthro.	18,948	9,933	18,170	14,979	13,171	8,900	13,752	10,101
Other SS	16,582	16,935•	17,179	22,363•	12,526	11,040	16,764	14,880

SOURCE: National Science Foundation, New Entrants Survey, 1978

- Data not available

. Women's salaries higher than men's

Women graduates in chemical engineering and civil engineering show higher salaries than men except among the 1976 master's graduates.

Among the 1976 graduates at the bachelor's level, the median salary is higher for women than for men in several of the fields where there are few women, such as physics and astronomy, earth sciences and these engineering subdisciplines; and the median salary for women is also slightly higher than for men among psychologists.

Among the 1972 graduates at both the bachelor's and master's levels, men report higher salaries than women in every field where there is any significant number of women.

In the 90 cases where the salaries of men and women could be compared by field, degree year and degree level, men have higher median salaries than women in 67 instances - or 75% of the time.

However, the salary gap between men and women is less for the 1976 class than for the 1972 graduates. We cannot tell for sure from the available data whether women have been able to obtain their proportionate share of these science and engineering jobs, but the data appear to indicate that they have not. For example, women are 22.4% of the 1976 master's graduates, but they hold only 18.3% of the full-time science and engineering jobs that are held by this class. Among the bachelor's graduates of that year, women are 32.5%, but they make up only 23.4% of the total employed full-time in science and engineering in 1978.

Among the 1972 graduates, women are 28.3% of the bachelor's graduates and 14.6% of that group who were employed fulltime in science and engineering in 1978. At the master's level, women earned 18.2% of the 1972 degrees, but are 14.1% of those employed in science and engineering. These differences may reflect the higher proportion of women than men who are out of the labor force for non-student reasons.

Some of this difference is in the field of study, since bachelor's degrees in fields typically chosen by women such as social sciences and psychology are less likely to lead to science and engineering employment than are bachelor's degrees in the physical sciences or engineering where men predominate.

Nonetheless, the higher unemployment rates for women in almost every field, coupled with the lower proportions of women employed in science and engineering from each segment of both classes and the generally lower salaries earned by these women may indicate that women have had less opportunity than men to find employment in science and engineering, regardless of their field.

Summary

Almost 83% of the women who graduated with a bachelor's and 90% of those who graduated with a master's degree in 1972 are in the labor force in 1978 or are pursuing a graduate degree on a full-time basis. Almost half of the women from these classes who have pre-school children are in the labor force.

Over the six years from 1972, more than a fourth of the bachelor's graduates have earned a master's degree and 4% have achieved a doctorate. Among the master's graduates of that year, 19% have earned a doctorate.

The strong dedication of these women to the labor force, as indicated both by their educational advancement and their labor force participation, indicates that a substantial majority of these women expect to remain in the labor force or to return to it as their children reach school age. Among the mothers from this group who report having children six and over, more than 90% are in the labor force.

The 1976 graduates also are substantially involved in graduate study or in the labor force. Only 5.6% of the bachelor's graduates and 8.0% of the 1976 master's graduates are out of the labor force for any reason except full-time graduate study.

Based on the patterns we have found throughout this study, about half of the women trained in science and engineering may remain in the labor force while their children are pre-school age. Most of those who do take career breaks will return. Indeed, the data in this survey show a strong pattern of women returning to school. Among the women in this sample who got degrees in 1976, 9.2% of the graduates (7.8% of the bachelor's recipients and 20.2% of the master's recipients) report having children six or over, indicating that they have already taken such a break, and were preparing to return to the labor force by obtaining the degree in 1976. The proportion of women graduates from the 1976 classes who have children six and over is higher than the proportion of the 1972 class who report school age children in 1978 - 9.2% and 7.5% respectively. At both bachelor's and master's levels, the proportion of women graduates reporting children six and over is higher in 1978 among 1976 graduates than among 1972 graduates.

The high unemployment rate experienced by mothers of pre-school and school age children in this sample suggests the lack of part-time job opportunities which was emphasized by women in other parts of this study. It may also reflect the difficulty of making adequate arrangements for child care for either full or part-time work. In some instances it may indicate the difficulty of re-entering the labor force following a career break - even one of short duration.

The data from this survey confirm the findings in Chapter 1 that women with degrees in science and engineering are strongly attached to the labor force despite their higher unemployment rates and their lower salary levels. In addition, this survey provides us with a strong indication that even those women who are out of the labor force while their children are under age 6 will generally return to the labor force when their children are school age.

CHAPTER 4

SCIENCE AND ENGINEERING GRADUATES FROM THE FRESHMAN CLASS OF 1961

One of the questions related to science manpower data is why the number of baccalaureate degrees granted in science appears to have so little relationship to the size of the scientific workforce at later periods. In February 1974, when the author was organizing a symposium for the annual meeting of the American Association for the Advancement of Science to consider problems of supply and demand for scientists and engineers, she asked Dr. Lewis Solmon, then working with the Commission on Human Resources of the National Academy of Sciences, to prepare a paper evolving from that question. That paper, entitled "Where Have All the Bachelor's Gone" raised as many questions as it answered, and Solmon later sought funds which were provided by the National Institute of Education for a more detailed analysis of career use of baccalaureate education. The College Placement Council provided resources to conduct a new follow-up survey of the Freshman Class of 1961.

Because Solmon was concerned only with baccalaureate graduates who did not pursue a graduate degree, his survey population was limited to those 1961 freshman who had received a baccalaureate but no higher degree by 1971 when they were surveyed for other studies. Questionnaires were sent in late 1974 and early 1975 to about 12,000 graduates who had entered college in 1961 and who had been working for up to ten years. Persons responding to this survey comprise almost exactly half of the respondents to the 1971 survey.

Because he was concerned only with those individuals who had not received an advanced degree, Solmon eliminated from his respondents those persons who had earned a higher degree by 1975, and the results of the study were published in 1977.*

Since the survey instrument used for Solmon's study included a great deal of information which would be useful in any study of the labor force participation of women who have earned a degree in science or engineering, he was asked to provide computer printouts of data for all the respondents to that study whose bachelor's degree was in a science or engineering field. The following discussion is based on answers supplied by 1,881 men and 1,131 women whose bachelor's degrees are distributed by field as shown in Table 4.1.

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* Solmon, Lewis C., Ann S. Bisconti and Nancy Ochsner, College As a Training Ground for Jobs, New York; Praeger Publishers (in cooperation with the Higher Education Research Institute,) 1977.

TABLE 4.1

HIGHEST DEGREE ATTAINED IN 1974-75 BY 1961 FRESHMEN WITH SCIENCE/ENGINEERING BACHELOR'S DEGREE, BY SEX*

	HIGHEST DEGREE							
	Total		Bachelor's		Master's		Doctorate	
	No.	% by sex	No.	%	No.	%	No.	%
TOTAL	3,013	100.0	2,507	83.2	397	13.2	109	3.6
Men	1,881	62.4	1,514	80.5	281	15.0	86	4.6
Women	1,132	37.6	993	87.7	116	10.2	23	2.0
BIO SCIENCES	489	100.0	407	83.2	58	11.9	24	4.9
Men	237	49.7	189	79.7	34	14.3	14	5.9
Women	252	51.3	218	86.5	24	9.5	10	4.0
MATH SCIENCES	401	100.0	332	82.8	63	15.7	6	1.5
Men	256	63.7	203	79.3	49	19.1	4	1.6
Women	145	36.3	129	89.0	14	9.7	2	1.4
CHEM & BIOCHEM	234	100.0	194	82.9	25	10.7	15	6.4
Men	157	67.2	122	77.5	23	14.6	12	7.6
Women	77	32.8	72	93.5	2	2.6	3	3.9
PHYSICS	89	100.0	64	71.9	14	15.7	11	12.4
Men	79	88.8	55	69.6	13	16.5	11	13.9
Women	10	11.2	9	90.0	1	10.0	-	-
OTHER PHYS. SCI	42	100.0	36	85.7	5	11.9	1	2.4
Men	35	82.9	30	85.7	4	11.4	1	2.9
Women	7	17.1	6	85.7	1	14.3	-	-
ENGINEERING	430	100.0	361	83.9	60	14.0	9	2.1
Men	386	89.8	326	84.5	53	13.7	7	1.8
Women	44	10.2	35	79.5	7	15.9	2	0.4
ECONOMICS	330	100.0	390	87.9	30	9.1	10	3.0
Men	255	77.2	227	89.0	19	7.5	9	3.5
Women	75	22.8	63	84.0	11	14.6	1	1.3
SOCIOLOGY	325	100.0	281	86.5	38	11.7	6	1.8
Men	119	36.6	91	76.5	22	18.5	6	5.0
Women	206	63.4	190	92.2	16	7.8	-	-
PSYCHOLOGY	336	100.0	270	80.4	54	16.1	12	3.6
Men	173	51.8	127	73.4	36	21.0	10	5.8
Women	163	48.2	143	87.7	18	11.0	2	1.2
OTHER SOC. SCI	337	100.0	272	80.7	50	14.8	15	4.5
Men	184	54.4	144	78.3	28	15.2	12	6.5
Women	153	45.6	128	83.7	22	14.4	3	2.0

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* Sample omits all graduates who earned an advanced degree by 1971.

Educational Attainment

Since this sample is limited to those graduates who, in the ten years after their freshman year had not completed any advanced degree, a surprisingly large portion of them either had completed a graduate degree by 1974-75 or indicated that they were students. Fifteen percent of the men and 10.2% of the women in this sample had earned the master's degree since 1971, with an additional 4.6% of the men and 2% of the women reporting a doctorate.

In addition, 31 men and 49 women who were out of the labor force in 1974-75 reported that they were students at the time of the survey. The questionnaire did not request student status information except from those persons who were out of the labor force, so some additional portion of respondents probably were pursuing graduate work while also employed.

Although the proportion of men from this sample who have already earned an advanced degree is higher than the proportion of women, 4.3% of the women in the sample compared to only 1.6% of the men indicated that they were students and not employed in 1974-75. Table 4.1 shows the number and percent of men and women in this sample by their highest degree and field in 1974-75.

Employment Status

Table 4.2 shows the number by sex and field who were in the labor force (employed full-time, employed part-time or seeking employment) and who were out of the labor force. For the latter group, student status is indicated as is the proportion who were involved in home care.

Women Out Of The Labor Force

Reasons Not Employed

Only 2% of the men, but 37% of the women reported themselves as being out of the labor force. These proportions match well with the Census Bureau data which reports that 64.1% of all women with four or more years of college were in the labor force in 1975.* Indeed, the figure may indicate surprising strength in labor force participation

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* A Statistical Portrait of Women in the United States, Bureau of the Census, Special Studies Series P-23, No. 58, April 1976, p. 29

TABLE 4.2

EMPLOYMENT STATUS IN 1974-75, BY FIELD OF BACHELORS DEGREE & SEX

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		LABOR FORCE					OUTSIDE LABOR FORCE					
	Total	Total	Full Time	Part Time	Seeking Empl.	Unempl. Rate	Total	Percent of 1	Student	Percent of 7	Home Care	Percent of 7
TOTAL	3,012	2,555	2,307	186	62	2.4	457	15.2	70	15.3	401	87.7
Men	1,881	1,841	1,768	35	38	2.1	40	2.1	31	77.5	8	20.0
Women	1,131	714	539	151	24	3.4	417	36.9	49	11.8	393	94.2
BIO SCIENCES	489	389	315	62	12	3.1	100	20.4	19	19.0	86	86.0
Men	238	233	221	7	5	2.1	5	2.1	4	80.0	-	-
Women	251	156	94	55	7	4.5	95	37.8	15	16.0	86	90.5
MATH SCIENCES	400	339	314	27	8	2.4	61	15.3	7	11.5	60	98.4
Men	255	253	246	3	4	1.6	2	0.8	2	100.0		
Women	145	86	68	14	4	4.6	59	40.7	5	8.5	60	101.7
CHEM & BIOCHEM	235	206	184	13	9	4.4	29	12.3	8	27.6	23	79.3
Men	158	153	141	4	8	5.2	5	3.2	6	100.0	-	-
Women	77	53	43	9	1	1.9	24	31.2	2	8.3	23	95.8
PHYSICS	89	80	76	2	2	2.5	9	10.1	3	33.3	4	44.4
Men	79	75	71	2	2	2.7	4	5.1	1	25.0	-	-
Women	10	5	5	-	-	-	5	50.0	2	40.0	4	80.0
OTHER PHYS. SCI	41	35	32	2	1	2.9	6	14.6	3	50.0	3	50.0
Men	34	30	28	1	1	3.3	4	11.8	3	75.0	1	25.0
Women	7	5	4	1	-	-	2	28.6	-	0.0	2	100.0
ENGINEERING	430	428	419	3	6	1.4	2	0.5	2	100.0	2	100.0
Men	386	386	377	3	6	1.6	0	0.0	2	-	-	-
Women	44	42	42	-	-	-	2	4.5	-	-	2	100.0
ECONOMICS	329	298	288	7	3	1.0	31	9.4	6	19.4	21	67.7
Men	254	246	241	2	3	1.2	8	3.1	5	62.5	1	12.5
Women	75	52	47	5	-	-	23	30.7	1	4.3	20	87.0
SOCIOLOGY	325	226	192	27	7	3.1	99	30.5	8	8.0	97	98.0
Men	119	115	110	2	3	1.8	4	3.3	-	-	5	125.0
Women	206	111	82	25	4	3.6	95	46.1	8	8.4	92	96.8
PSYCHOLOGY	336	271	237	26	8	3.0	65	19.3	13	20.0	57	37.7
Men	174	170	162	4	4	2.4	4	2.3	5	100.0	-	-
Women	162	101	75	22	4	4.0	61	37.7	8	13.1	57	93.4
OTHER SOC. SCI	338	283	250	27	6	2.1	55	16.3	11	20.0	48	87.3

when we note that among these 32-year old women, all who had earned a graduate degree within ten years of their freshman year have been excluded from the sample.

Although the questionnaire offered an opportunity for multiple responses as to the reason for being out of the labor force, the number involved in home and child care plus the number who reported themselves as students account for approximately all of the men and women who were out of the labor force.

Among all those who were neither employed nor seeking employment, only 61% reported that they do not want a job now, so apparently some would like to work but are not looking for a job in any active way. Despite the multiple responses allowed by the question, the answers provide some hint about why that remaining 35% who might want a job at this time were not actively seeking work.

TABLE 4.3

REASONS FOR BEING OUT OF THE LABOR FORCE

	No.	%
Total Women in Sample	1,131	
Total Women Not Employed	441	39.0
REASONS	No.	% of 441
Don't Want a Job now	270	61.2
In School	49	11.1
Voluntary Home Care	379	85.9
Home Care - No Alternative	14	3.2
Can't Find Part-Time Work	52	11.8
Unsure How to Find a Job	9	2.0
Apprehensive About Job Search	17	3.0
Unable to Find a Suitable Job	24	5.4
Spouse Discourages My Working	43	9.8
Prefer Volunteer Work	92	20.9

Among these women, almost 12% say they cannot find part-time work. Many of them indicate uncertainty or apprehension about finding a job, and particularly a suitable job. A somewhat surprising 21% of all the women who are out of the labor force indicated that they prefer volunteer work. This group undoubtedly includes some of the 10% who indicated that their spouses discourage their employment.

However, an overwhelming majority of the women who were out of the labor force are voluntarily involved in home and child care. Almost 86% gave this response, with an additional 3.2% indicating that they were performing home and child care because they had no alternative. Since they were all about 32 years old at the time of the survey, a majority may have pre-school age children.

Time Out Of the Labor Force

A substantial majority of these women (81.2%) have been out of the labor force for a year or more. Only 3.4% had never been in the labor force while 11.5% indicated that they were last employed within the past four to 12 months and 3.8% that they were last employed within the past three months.

Plans To Return To the Labor Force

Their future plans about labor force participation are generally positive. Only 7.2% indicate that they plan never to seek a job while 8.6% indicate plans to return to the labor force within one year, 35.7% plan to return in one to five years, and 9.5% plan a return after five years. One-third say they are uncertain when they will seek a job. Among the 441 women who were not employed at the time of the survey, 60% are either currently seeking work or indicate positive plans to return to the labor force. Half of them expect to be working within five years.

Women In The Labor Force

Variance By Field

Labor Force participation is strikingly different among degree fields, varying from 54% of graduates in sociology and 59% in the mathematical sciences to 67% in the physical sciences, 69% in economics and an astonishing 95% in engineering. There may be a number of reasons why the women engineers are so much more strongly attached to the labor force than are graduates in any of the sciences. Although there were only 44 women engineers in the sample, 42 of them were employed full-time.

These figures may reflect the significant difference in the professional nature of the baccalaureate degree in engineering compared with the science fields. This supposition is reinforced by the fact that the proportion of women from this group of 1961 freshman who are students out of the labor force about ten years after completing their baccalaureate degree is highest in the biosciences (6%) and psychology (5.2%), probably indicating that these women want to reenter the labor force and recognize the need for higher education credentials if they are to compete successfully for jobs in these fields. Among the engineers, none were students.

The higher incidence of labor force participation among engineers, physical scientists and economics majors may also reflect better job opportunities in these fields. The available salary information for these women shows at least one significant reason why women engineers are working while women in the social and biosciences find less incentive based on the salaries available to them. For example, among all women bioscientists reporting salaries above $10,000 a year, 74.2% were earning less than $14,000. Among the women engineers, only 7.1% earned less than $14,000 while more than 40% earned over $20,000 per year. Only women with majors in economics and those with majors in engineering included any significant number of women reporting high salaries. In the entire sample, only 20 women reported salaries of $30,000 or more, and nine of the 20 (45%) were majors in engineering or economics although women with these majors were only 13.6% of the total number of employed women.

Employment History

The women engineers in this sample also have been employed consistently in full-time work in a much higher proportion than the women in any of the science fields. The typical graduate in this sample without an advanced degree has been out of school for nine to ten years. Among the women engineers, 97.8% have been employed full-time for five or more years compared to 60.7% of the physical science and math graduates, 57.8% of the social science majors and 54.4% of the bioscience majors. Among the men, proportions are 94.3% of engineers, 86.2% of physical scientists, 89.6% of social scientists and 88.2% of bioscientists.

Women engineers also show significant job stability with the same employer, and an even higher stability than the male engineers. Among the women engineers, 81.8% had had the same employer for more than three years - the longest category in the questionnaire - compared to 76.7% of the male engineers. Among employed physical scientists, 50% of the women had been with the same employer for three or more years as

TABLE 4.4

NUMBER AND PERCENT IN CURRENT OR MOST RECENT OCCUPATIONAL GROUP BY DEGREE FIELD AND SEX

FIELD OF EMPLOYMENT	SEX	FIELD OF DEGREE Biol. Sci.	Math Sci.	Chem. & Biochem.	Physics	Other Phys. Sci.	Engrg.	Econ.	Soc.	Psych.	Other Soc. Sci.	Total
TOTAL EMPLOYED	M	235	251	146	77	32	379	248	113	169	181	1,831
	F	242	140	76	10	7	43	70	198	158	144	1,088
NATURAL & CONSERVATION SCIENCES	M	29	3	39	8	6	-	1	-	1	1	88
	F	26	-	18	1	3	1	-	1	-	2	52
(Percent)	M	12.3	1.2	26.7	10.4	18.8	-	0.4	-	0.5	0.6	4.8
	F	10.7	-	23.7	10.0	42.9	2.3	-	0.5	-	1.4	4.8
HEALTH PROFESSIONAL	M	8	-	11	-	-	1	1	-	6	1	28
	F	16	1	3	-	-	-	-	1	4	1	26
(Percent)	M	3.4	-	7.5	-	-	0.3	0.4	-	3.6	0.6	1.5
	F	6.6	0.7	3.9	-	-	-	-	0.5	2.5	0.7	2.4
ALLIED HEALTH AND TECHNICIANS	M	25	2	18	6	1	2	-	0	3	-	57
	F	34	1	26	1	-	-	1	3	5	3	134
(Percent)	M	10.6	0.8	12.3	7.8	3.1	0.5	-	-	1.8	-	3.1
	F	14.0	0.7	34.2	10.0	-	-	1.4	1.5	3.2	2.1	12.3
ENGINEER AND ARCHITECT	M	1	18	6	20	2	223	3	2	1	5	281
	F	2	-	2	3	0	26	2	-	-	-	35
(Percent)	M	0.4	7.2	4.1	26.0	6.3	58.8	1.2	1.8	0.6	2.8	15.3
	F	0.8	-	2.6	30.0	-	60.5	2.9	-	-	-	3.2
MATHEMATICS AND COMPUTER SCIENCES	M	6	69	1	9	4	23	14	2	7	5	140
	F	2	45	3	3	-	1	4	3	11	6	78
(Percent)	M	2.6	27.5	0.7	11.7	12.5	6.1	5.6	1.8	4.1	2.8	7.6
	F	0.8	32.1	3.9	30.0	-	2.3	5.7	1.5	6.9	4.2	7.2
SOCIAL SCIENCES AND SOCIAL WELFARE	M	2	-	-	-	-	1	-	12	7	6	28
	F	3	-	-	-	-	-	6	60	25	7	101
(Percent)	M	0.8	-	-	-	-	0.3	-	10.6	4.7	3.3	1.5
	F	1.2	-	-	-	-	-	8.6	30.3	15.8	4.9	9.3
TEACHER	M	48	75	13	7	6	4	13	12	23	26	227
	F	51	62	8	1	1	-	11	41	42	38	255
(Percent)	M	20.4	29.9	8.9	9.1	18.8	1.1	5.2	10.6	13.6	14.4	12.4
	F	21.1	44.3	10.5	10.0	14.3	-	15.7	20.7	26.6	26.4	23.4
BUSINESS OWNER OR ADMINISTRATOR	M	33	34	17	7	6	47	80	24	34	37	318
	F	7	8	4	-	-	5	14	16	15	22	91
(Percent)	M	14.0	13.5	11.6	9.1	18.8	12.4	32.3	21.2	20.1	20.4	17.4
	F	2.9	5.7	5.3	-	-	11.6	20.0	8.1	9.5	15.3	8.4

NUMBER AND PERCENT IN CURRENT OR MOST RECENT OCCUPATIONAL GROUP BY DEGREE FIELD AND SEX (CON'T)

		Biol. Sci.	Math Sci.	Chem. & Biochem.	Physics.	Other Phys. Sci.	Engrg.	Econ.	Soc.	Psych.	Other Soc. Sci.	Total
BUSINESS, ACCOUNTING, SALES, SECRETARIAL	M	18	17	8	3	1	18	64	15	30	26	197
	F	5	5	2	1	-	2	17	20	19	27	98
(Percent)	M	7.7	6.8	5.5	3.9	3.1	4.7	25.9	13.3	17.8	14.4	10.8
	F	2.1	3.6	2.6	10.0	-	4.7	24.3	10.1	12.0	18.8	9.0
GOVERNMENT ADMINISTRATOR	M	8	6	2	2	-	7	9	4	10	15	63
	F	5	1	1	-	-	1	3	5	3	10	27
(Percent)	M	3.4	2.4	1.4	2.6	-	1.8	3.6	3.5	5.9	8.3	3.4
	F	1.2	0.7	1.3	-	-	2.3	4.3	2.6	1.9	6.9	2.5
MILITARY SERVICE	M	8	10	5	4	3	21	7	9	8	8	83
	F	-	2	-	-	-	4	1	1	-	-	8
(Percent)	M	3.4	4.0	3.4	5.2	9.4	5.5	2.8	7.9	4.7	4.4	4.5
	F	0.0	1.4	-	-	-	9.3	1.4	0.5	-	-	0.8

had 54.6% of the mathematics majors, 46.9% of the social science graduates and only 39.2% of the bioscience graduates.

Among the men in this sample, 72% had had the same employer for three or more years with the range by field from 59.5% in psychology to 77.2% in mathematics.

Occupations of Employed Women Graduates

The nature of the questionnaire does not allow us to distinguish between the occupations of graduates in this sample who are presently employed and those who were formerly employed and list their most recent occupation. Table 4.4 shows the number and percent of men and women with degrees in each of these science fields who list their current or most recent occupation. The eleven occupational groupings in this table have been combined from the 38 occupations listed in the questionnaire.

Both men and women engineers are significantly more likely to be working in engineering than in any other field, with similar proportions of both sexes having moved into the area of business ownership or high level administration. Among men, 58.8% are working as engineers and 12.4% are business owners or high level administrators. Among the women, 60.5% are working as engineers and 11.6% are in the business owner or top administrator category. In no other field of the baccalaureate is there such a strong relationship between degree field and present occupation, for either sex.

While almost a third of the women with a major in mathematical sciences list their occupation as math or computer science, an even higher proportion (44.3%) are teachers, most of them in elementary and secondary edcuation. Among men graduates in that field, 27.5% list math or computer sciences as their occupational field and 29.9% are educators while 13.5% of the men and only 5.7% of the women are business owners or high level administrators.

Among women with majors in chemistry or biochemistry, 23.7% are working in the area of natural or conservation sciences with an additional 34.2% working in allied health or as technicians. For the men, 26.7% are in the natural or conservation sciences and only 12.3% in allied health or technician fields. Again, a significant fraction of the men are business owners or administrators. The proportion who are teachers is only about ten percent for either sex.

The physics and the "other physical science" majors represent small numbers, particularly for women. However, most of these women, together with their male classmates, appear to be working in areas related to their physical science majors.

Among the bioscientists, about one-fifth of each sex list teaching as the major occupation with other concentrations in the natural and conservation sciences, the health professions and the allied health and technician groups. Among the men, 14% are business owners or high level administrators, but only 2.9% of the women list these occupations.

Except for the economics majors, about one-fourth of the women graduates in the social science fields and in psychology list teaching as their current or most recent occupation. Among men in these fields, the proportion in education is much smaller. The men tend to be business owners or high level administrators. Except among sociology graduates, where 30% of the women list social sciences or social welfare as their field, the social science majors are likely to be working in some other area of business or education, including secretarial positions.

Among the economics majors, 32.3% of the men and 20% of the women are business owners or high level administrators, with an additional 25.9% of the men and 24.3% of the women working in business as accountants, salesmen, buyers, or secretaries.

Salaries

As a group, the men in this study are twice as likely to be in high level administrative jobs (20.8%) as are women (10.9%). Women are more likely to be educators, (23.4), almost all of them at the elementary and secondary level. These occupational groupings are strongly reflected in the salary groupings.

The data available to us from this survey do not allow a breakout of salaries between those who are full-time and part-time employed or between those who are reporting a previous salary rather than a current one. The questionnaire requested annual salary, either current or most recent. Thus, the salary figures available are not as useful as we would like as a tool for studying the incentives or disincentives for labor force participation of women. Nonetheless, some useful comparisons can be made.

Table 4.5 shows the total number employed by field and sex, and the total number who are employed full-time. When all those persons who report salary below $10,000 are eliminated from the salary tables the remaining numbers approximate the numbers of persons employed full-time. While we cannot assume that all those reporting salaries below $10,000 are part-time employees or former employees listing previous salaries, we can examine that group reporting salaries above $10,000 and note some significant differences.

More than half of the women who report salaries above $10,000 are in the salary range of $10,000 to $13,900. This includes almost three-fourths of the bioscientists and about two-thirds of the sociologists and psychologists. For the men, only 23.1% of those whose salaries are above $10,000 report a salary as low as $13,900, but again the biological scientists and sociologists are most likely to be in these lower salary categories.

Only in engineering do we see comparable salary groups for men and the women, and those salaries are higher than for graduates in any other field. Men and women

TABLE 4.5

SOME SALARY COMPARISONS

		Biol. Sci.	Math Sci.	Chem. & Biochem.	Physics	Other Phys. Sci.	Engrg.	Econ.	Soc.	Psych	Other Soc. Sci.	Total
Total Employed	M	228	249	145	73	29	380	243	112	166	178	1,803
	F	149	82	52	5	5	42	52	107	97	99	690
Full-Time Employed	M	221	246	141	71	28	377	241	110	162	171	1,768
	F	94	68	43	5	4	42	47	82	75	79	539
No. Reporting Salary above $10,000	M	192	243	142	66	28	368	227	100	150	166	1,690
	F	97	73	43	4	4	42	45	81	71	71	531
						PERCENT						
$10,000 - $13,900	M	40.6	29.6	21.8	22.7	35.7	6.8	18.1	33.0	26.0	32.5	23.1
	F	74.2	42.5	48.8	50.0	75.0	7.1	28.9	66.6	63.4	50.7	52.7
$14,000 - $19,900	M	40.6	46.7	51.4	51.5	42.9	52.2	42.7	43.0	46.7	44.0	46.5
	F	18.6	39.7	39.5	25.0	25.0	52.4	37.8	17.3	28.2	16.9	28.4
$20,000 - $29,900	M	16.7	21.0	21.8	24.2	21.4	37.8	28.2	20.0	22.7	23.5	25.6
	F	6.2	13.7	9.3	25.0	0.0	35.7	17.8	11.1	8.4	21.1	13.9
Above $30,000	M	5.2	2.5	4.9	3.0	0.0	3.2	11.0	4.0	3.3	6.0	4.8
	F	1.0	4.1	2.3	0.0	0.0	4.8	15.6	4.9	0.0	2.8	3.8

majors in economics show a closer relationship in this salary comparison than do those in any other field except engineering. The sample is small in both these fields.

By field, bioscientists and sociologists have the lowest salaries, and it is in these fields that the women also report significantly lower salaries than the men. The fact that almost 38% of the women in these two fields are out of the labor force, perhaps emphasizes the relationship between low labor force participation and poor salary incentives. Engineering and economics, where the salary levels are considerably higher, also show significantly higher participation in the labor force by women graduates in these fields.

Summary

While this sample of men and women graduates in science excludes all of those students from the freshman class of 1961 who obtained a bachelor's in science and who had also obtained an advanced degree within ten years, it tells us that even in this remaining group, the labor force participation of women with degrees in these fields is 63% at a time when their children are most likely to be young.

The very striking difference in labor force participation by women engineers as compared to women in the sciences may be in part a reflection of the fact that a bachelor's degree is the first professional degree in engineering while an advanced degree is generally considered necessary for professional work in most of the science fields.

The difference in labor force participation between the engineers and the scientists almost certainly reflects the better job opportunities for women in engineering and the high salary levels, both in comparison to the science fields and in relation to salaries of men engineers. In the science fields, the women's salaries are significantly below men's in the same field.

The participation of married women in the labor force is undoubtedly related to a combination of incentives and disincentives. Incentives probably include the availability of interesting jobs at good salaries, while the major incentive to be out of the labor force probably is the desire to have and take care of young children.

These women, who were approximately 30 to 32 years old at the time of the survey, were in the peak years (among college graduates) for having children below school age. The high labor force participation rate among the women engineers and economists may mean that the incentive for labor force participation that is represented by the opportunity for an interesting job at a good salary is strong enough to overcome the incentive to be out of the labor force because of young children. Data in Chapters 3 and 5 tend to confirm this supposition.

We do not have information on either the marital or parental status of the women in the sample. However, as indicated in other parts of this study, women with higher educational achievement are much more likely to be in the labor force regardless of whether they have young children than are women with less education. Since this sample does not include any members of the freshman class of 1961 who had already attained an advanced degree by 1971, the 63% labor force participation rate of this group of women seems quite high in light of both their age and the fact that those members of their class who moved ahead more rapidly to advanced degrees are not included in the sample.

While it cannot be assumed that all women would choose to participate in the labor force regardless of whether or not they have small children if job incentives and salaries were excellent, it is equally illogical to suppose that these incentives do not matter and that women engineers would remain in the labor force in such high proportions if their job opportunities were poor and their salaries significantly lower.

Among all of the women in this sample who were out of the labor force, only 7% indicate that they do not plan to return to work at some time in the future. Almost 12% of those who are out of the labor force are students, about ten years after completing their bachelor's degree. Their student status may indicate an intention to upgrade their educational credentials or to update their skills or both, but it certainly indicates plans for future employment. About 12% of the total group of women in this sample have completed a graduate degree within the past four years.

Their statement of intent to return to the labor force, coupled with their recent and present participation in formal education indicates a strong likelihood that a majority of these women will be in the labor force as soon as they complete their present educational efforts or when their children are a little older.

CHAPTER 5

SURVEY OF A SAMPLE OF CHEMISTRY AND ENGINEERING GRADUATES OF THE PAST 15 YEARS

In order to examine in detail the educational and labor force participation outcomes across a series of classes from a number of schools, we sent questionnaires to all the women graduates of the past 15 years in chemistry or in engineering from a group of ten schools which could provide us with current addresses for these women.

Approximately 440 women engineering graduates from the University of Michigan, Michigan Tech, Purdue, Princeton, and Notre Dame were contacted. A total of 249 completed questionnaires were returned from these engineering graduates, for a return rate among the engineering graduates of about 56%. Because the questionnaires to engineering graduates of the University of Michigan were mailed by the University rather than by the Scientific Manpower Commission, we do not know the exact number sent out.

A total of 550 questionnaires were sent to chemistry graduates of the past 15 years at Mount Holyoke, American University, Susquehanna University, the University of Dayton and the University of Lowell. Completed questionnaires were returned from 358 women, for a return rate of 65%.

The following table shows the number of questionnaires sent to each school and the number returned.

TABLE 5.1

ENGINEERING			CHEMISTRY		
SCHOOL	# Sent	# Returned	SCHOOL	# Sent	# Returned
University of Michigan	N.A.	87	Mount Holyoke	332	220
Michigan Tech. University	86	57	American Univ.	56	39
Purdue University	176	85	Susquehanna	36	22
Notre Dame	6	4	Univ. of Dayton	75	53
Princeton	30	16	Univ. of Lowell	51	22
TOTAL		249	TOTAL	550	338

This sample of women does not represent all women graduates in chemistry or engineering, nor does it represent graduates in other science fields. Since we made no effort to follow-up after the first contact, the sample cannot even be said to represent accurately all of the graduates of these particular schools in these fields. However, the 607 completed questionnaires do provide us with some useful information that is not available through any other surveys.

Description of Sample

Table 5.2 shows several demographic characteristics of the sample, by field. The total sample is made up of 59% chemistry graduates and 41% engineering graduates. The chemists are more likely to have earned an advanced degree, as half of them have, than the engineering graduates, where about three-fourths of the group have only a bachelor's degree. Among the chemists, more than a fourth have earned a doctorate (either a Ph.D. or an M.D.) compared to only 2% of the engineers.

TABLE 5.2

DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

CHARACTERISTIC	CHEMISTRY			ENGINEERING			COMBINED SAMPLE		
—	No.	H %	V %	No.	H %	V %	No.	H %	V %
Total Sample	358	59.0	100.0	249	41.0	100.0	607	100.0	100.0
Highest Degree									
Bachelor's	180	49.2	50.3	186	50.8	74.7	366	100.0	60.3
Master's	79	57.7	22.1	58	42.3	23.3	137	100.0	22.5
Ph.D.	53	93.0	14.8	4	7.0	1.6	57	100.0	9.4
Professional	46	97.9	12.9	1	2.1	0.4	47	100.0	7.7
Age (by Groups)									
Born Before 1950	228	71.5	63.7	91	28.5	36.5	319	100.0	52.6
Born 1950-54	100	47.4	27.9	111	52.6	44.6	211	100.0	34.8
Born 1955 & After	30	39.0	8.4	47	61.0	18.9	77	100.0	12.7
Family Status									
Single	125	55.8	34.9	99	44.2	39.8	224	100.0	36.9
Married	214	60.1	59.8	142	39.9	57.0	356	100.0	58.6
Divorced	19	70.4	5.3	8	29.6	3.2	27	100.0	4.5
Have Children	146	67.9	41.3	70	32.1	28.1	216	100.0	35.6

SOURCE: Scientific Manpower Commission

We divided the sample into three age groups in order to examine labor force participation not only by age but also by marital status and presence of children. Women born before 1950 (and thus about 29 and over when surveyed in 1978) make up 63.7%

of the chemists but only 36.5% of the engineers. Those born in 1950-1954 (age 25-28) are a third of the total sample, but 45% of the engineering graduates; while those born in 1955 or later (about age 22-24) are 8.4% of the chemistry graduates and 18.9% of the engineering graduates, indicating the recent rapid increase in the number of women engineering graduates.

Although the chemistry graduates are older than the engineering graduates, the proportion of both groups that is married is similar - just under 60%. The chemistry graduates are much more likely than the engineering graduates to have children, which may reflect the age difference in the two groups.

Only six of the women in this sample (1.0%) said they were members of ethnic or racial minorities.

Labor Force Participation

Table 5.3 shows detail of labor force participation among women in this sample. Almost three-fourths are employed, 2.1% are seeking employment and 13.3% are out of the labor force because they are graduate students. Only 10% are out for family or other reasons.

The chemistry graduates are less likely than the engineering graduates to be employed (68.4% and 83.9%) but more likely to be graduate students (18.2% and 6.4%). The proportion who are out of the labor force for family and other reasons is similar for both groups (10.6% in chemistry and 8.4% in engineering), with the higher proportion in chemistry probably related to their higher incidence of children.

Among the employed graduates, the engineering graduates are more likely to be employed in science and engineering (S/E) than are the chemistry graduates (92.8% and 82.9% respectively) with 9% of the chemistry graduates and 6% of the engineering graduates employed part-time.

By degree level, 96% of the doctorate group (largely chemistry graduates who are about half Ph.D.'s and half M.D.'s) are in the labor force, with 86.5% working full-time. The two women with first professional degrees who are not working in science and engineering are both lawyers, and the remainder are employed in science or engineering.

Less than 4% of the doctorate group are out of the labor force.

TABLE 5.3

EMPLOYMENT STATUS BY DEGREE LEVEL AND FIELD

	TOTAL NO.	EMPLOYED					NOT EMPLOYED			
		Total No.	Full-Time S/E	Part-Time S/E	Full-Time Non-S/E	Part-Time Non-S/E	Total No.	Seeking Employment	Student	Family & Other
Chemistry	358	245	181	22	30	12	113	10	65	38
B.S.	180	93	63	8	17	5	87	5	55	27
M.S.	79	57	34	6	11	6	22	5	10	7
Ph.D.	53	49	44	4		1	4			4
LLB or M.D.	46	46	40	4	2					
Engineering	249	209	182	12	14	1	40	3	16	21
B.S.	186	159	142	8	8	1	27	3	11	13
M.S.	58	45	36	3	6		13		5	8
Ph.D.	4	4	3	1						
Prof.	1	1	1							
Total Sample	607	454	363	34	44	13	153	13	81	59
B.S.	366	252	205	16	25	6	114	8	66	40
M.S.	137	102	70	9	17	6	35	5	15	15
Ph.D.	57	53	47	5		1	4			4
Prof.	47	47	41	4	2					

SOURCE: Scientific Manpower Commission

At the master's level, 78.2% are in the labor force, including 3.7% who are seeking work, with an additional 10.9% involved full-time in graduate study. Only 10.9% are out of the labor force for family or other reasons.

Master's level chemists are less likely than the engineers to be working in science and engineering (50.6% of the chemists and 67.3% of engineers) with similar proportions working part-time in S/E. Among master's level chemists, the unemployment rate is 8.1% - higher than for any other group - which may also indicate a reason for less S/E employment in this group. More of the engineering graduates (13.8%) than the chemists (8.9%) at this degree level are out of the work force for family and other reasons, while almost 13% of the chemists and 8.6% of the engineers are graduate students.

Bachelor's level graduates are more likely than those with advanced degrees to be in graduate school (18.0%) with 30.6% of the chemistry graduates and 6.4% of the engineering graduates being students out of the labor force. About 10% of the chemistry graduates and 8% of the engineering graduates at the baccalaureate level are out of the labor force for family and other reasons.

Among the employed graduates, 76% of the bachelor's level chemistry graduates and 94% of the engineering graduates are working in S/E, with 3% of the engineers and 8.6% of the chemistry graduates employed part-time in S/E. About a fourth of the employed chemists are working outside S/E, with three-quarters of this group working full-time.

Thus, it is apparent that this group of women graduates, like the women graduates in the other data sets we have examined for this study, are highly involved in the labor force or in graduate school where they are preparing to enter the labor force.

Labor Force Participation Related to Parental Status

Among these 607 women, 216 (35.6%) have children, and because the sample includes graduates of only the past 15 years, the majority who have children have young children. Table 5.4 correlates employment and student status by degree level and parental status.

Among these 216 women who have children, 64.4% are working. Among the chemistry graduates, the proportion is 61.6% and among the engineering graduates 70%. These findings can be compared with the findings of Connelly, Burks and Rogers[1] who found that 85.6% of the mothers in their sample of 1,071 women scientists and engineers were in the labor force.

The women in the Connelly sample are older than the women in the SMC sample, with 40% being age 40 or above at the time of the survey. Thus, although 40% of the women in the Connelly sample had children, only 33% had children still living at home; and only 15% had children under age 6, with an additional 8% having children age 7-12. In the SMC sample, on the other hand, 35.6% have children, and 32.8% have children under age six.

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[1] The Woman Professional in Science and Engineering: An Empirical Study of Key Career Decisions, by Terence Connolly, Esther Burks and Jean Rogers, Final Technical Report to the National Science Foundation, April 1976

Both studies indicate higher labor force participation among mothers at higher degree levels.

In the SMC sample, 90.5% of the mothers with a Ph.D. or first professional degree are working, as are 74.1% of the master's graduates and 50.8% of the bachelor's graduates. How much the labor force participation rate is correlated to the opportunities for S/E employment may be inferred by noting that 70% of the engineering graduate mothers at the bachelor's level (a professional entry degree) are at work compared to only 38.4% of the mothers whose highest degree is a bachelor's in chemistry. Opportunities at the baccalaureate level in chemistry are limited. At the higher degree levels, with better opportunities for S/E employment for chemists, high proportions of women are at work.

TABLE 5.4

EMPLOYMENT AND STUDENT STATUS, BY FIELD, DEGREE LEVEL AND PARENTAL STATUS

		EMPLOYED		NOT EMPLOYED					
	Total No.	Children	No Children	Student No Children	Student With Children	Non-Student With Children	Total With Children	% With Children	% of Mothers Who Work
Chemistry	358	90	155	55	20	36	146	40.8	61.6
BA/BS	180	28	65	45	18	27	73	40.6	38.4
MA/MS	79	24	33	10	2	5	31	39.2	77.4
Ph.D/MD	99	38	57			4	42	42.4	90.5
Engr'g.	249	49	160	13	2	19	70	28.1	70.0
BS	186	33	126	8	2	12	47	25.3	70.2
MS	58	16	29	5		7	23	39.6	69.6
Ph.D.	5		5						
Total Sample	607	139	315	68	22	55	216	35.6	64.4
BA/BS	366	61	191	53	20	39	120	32.8	50.8
MA/MS	137	40	62	15	2	12	54	39.4	74.1
Ph.D./MD	104	38	62			4	42	40.4	90.5

SOURCE: Scientific Manpower Commission

Career Breaks

Table 5.5 shows the number of women in this sample who have had breaks in employment of six months or more since completing their bachelor's degree, with the reason for the break, among women who are presently employed.

TABLE 5.5

CAREER BREAKS AMONG GRADUATES PRESENTLY EMPLOYED

	Total Employed	Total With Breaks		Breaks for School		Breaks for Other	
		No.	%	No.	%	No.	%
Chemistry Graduates	234*	124	53.0	37	15.8	87	37.2
Engineering Graduates	208*	52	25.0	23	11.1	29	13.9
TOTAL	442*	176	39.8	60	13.6	116	26.2

*No. of respondents who answered the question.

Of 234 employed chemists who answered this question, 87 (37.2%) have taken breaks for non-school reasons. Among the 208 engineering graduates presently employed only 29 (13.9%) have had a non-school break. Including breaks for graduate school, 53% of the chemists and 25% of the engineers have had breaks of six or more months in their employment following receipt of the bachelor's degrees.

Adding the 59 women in the sample who are presently out of the labor force for non-school reasons (9.7% of the total group), we find that 175 of the total 607 in the sample (17.3%) have taken or are taking breaks.

Among women in the Connolly sample, 38% have taken a career break of more than six months for any reason, and 73% of these women already have returned to employment, with an additional 9% presently seeking work. We cannot distinguish those in the sample whose employment breaks are solely to return to school, although 23% of those taking breaks gave this reason.

The effect of career breaks on reemployment and advancement was examined only indirectly in the SMC sample by the use of an open question regarding the effect of a number of factors on career development, and through the comments that were offered. However, we also examined salary information as an indicator of the effect of career breaks. The sample was too small to use for this purpose after adjusting for age, degree level and field which are also important indicators of salary. But the salary information does provide some indicators.

Table 5.6 shows salaries by degree level of the 372 women employed full-time who provided salary data. Part-time employment, which is known to be affected by family status, also affects salary, and was not included in this comparison.

TABLE 5.6

SALARY RANGES (IN THOUSANDS) OF FULL-TIME EMPLOYED BY DEGREE LEVEL AND FIELD

	<9	9-11	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	38-46	>46
Chemistry	9	17	37	44	18	22	11	11	4	1	3	5	3
BA/BS	6	10	12	23	6	6	5	2					
MA/MS	3	6	11	9	7	2	1	5	1				
Ph.D.		1	5	5	3	8	4	3	2			2	
Prof.			9	7	2	6	1	1	1	1	3	3	3
Engineering	5	1	7	48	73	32	12	8		2			
B.S.	5	1	6	41	58	19	6	1		2			
M.S.			1	6	14	12	6	5					
Ph.D.					1	1		2					
M.D.				1									
Total Sample	14	18	44	92	91	54	23	19	4	3	3	5	3
BA/BS	11	11	18	64	64	25	11	3		2			
MA/MS	3	6	12	15	21	14	7	10	1				
Ph.D.		1	5	5	4	9	4	5	2			2	
Prof.			9	8	2	6	1	1	1	1	3	3	3

As expected, the engineers as a group earned consistently higher salaries than the chemistry graduates at both the bachelor's and master's levels. The bulk of the engineering bachelor's graduates (72%) earn between $14,000 and $20,000, with 20% earning more than $20,000 and 9% earning less than $14,000. Among chemistry graduates at the bachelor's level, only 41% report salaries in the $14,000 to $20,000 range, with 40% below $14,000 and only 18% above $20,000.

The doctorate level chemistry graduates also show a pattern that may be related to career breaks, with 28 women (37%) earning less than $17,000 and 41 (55%) earning more than $20,000.

Salaries of these full-time workers ranged from $3,800 to $60,000 per year among the chemistry graduates, with the highest earnings reported by M.D.'s. The salary range among the engineers was smaller - $8,500 to $33,000. However, the average salary is similar for both groups being $18,200 for the chemists and $18,600 for the engineers, despite the fact that the total educational investment among chemistry graduates is considerably higher than among the engineers.

While a statistical correlation of salaries with career breaks is not possible in this small sample, the number of full-time workers among these graduates who report salaries significantly below the entering salary level for their field and degree level in 1978 indicates some monetary effect of taking time out of the labor force for activities other than graduate school.

An important indicator of future labor force participation among women who are presently out of the labor force is found in their plans to return to the labor force. Table 5.7 shows the number who are out of the labor force (including student and non-student status) and the number who indicate positive plans to return to the labor force. Among the 38 women chemists who are out of the labor force for other than student reasons, 32 say they plan to return to work. Twenty five of them plan to return in science and engineering and 19 indicate the need for some refresher training before reentry.

TABLE 5.7

PRESENT PLANS TO RETURN TO WORK

	Total Out of Labor Force (1)	In School Plan Work (2)	Not in School (3)	Plan to Return (4)		Plan Return in S/E (5)		Skills Will Need Updating (6)	
				No.	% of 3	No.	% of 4	No.	% of 4
Chemistry	103	65	38	32	84.2	25	78.1	19	59.4
Engineering	37	16	21	15	71.4	13	86.7	11	73.3
Total	140	81	59	47	79.7	38	80.9	30	63.8

Only 21 engineers who are not students are out of the labor force, and 15 of these indicate definite plans to return to work with 13 saying they will try to return in science and engineering and 11 feeling they will need updating of skills or refresher training.

In this sample then, 80% of the women not presently working or going to school indicate positive plans to return to work. If we assume that all or most of the women presently in graduate school plan to enter or reenter the labor force when their training is completed, then 91% of the women graduates in this sample who are presently out of the labor force expect to enter or reenter within a reasonable, stated time. Only 12 women in the sample of 607 (2%) are out of the labor force and do not indicate definite plans to return.

Relatedness of Husband's Field and Degree Level with Wife's Employment Status

Perhaps women who are married, and certainly women with children face more difficulty in pursuing a career than do single women. We wanted to find out if the information provided by the women in this sample would show any correlation between career development among married women when the husband and wife were in a related or in a non-related field; and whether any correlation seemed apparent that was dependent on the degree level of the spouses relative to each other.

Table 5.8 shows that bachelor's level women whose husbands are in non-related fields are considerably more likely to be working full-time in science and engineering than those whose husbands are in related fields. These women are also more likely to be in the labor force than are those at the bachelor's level whose husbands are in a related field.

At the higher degree level, the tendency to be in the labor force is evident, but women at the master's level whose husbands are in related fields are more likely to be employed outside of S/E than those whose husbands are in non-related fields, perhaps indicating more difficulty in finding two S/E jobs in one family.

TABLE 5.8

FIELD RELATEDNESS OF SPOUSES BY HER HIGHEST DEGREE AND HER EMPLOYMENT STATUS

Relatedness of Couples' Fields and Her Highest · Degree	TOTAL	HER EMPLOYMENT STATUS											
		EMPLOYED						NOT EMPLOYED					
		Full-Time S/E		Full-Time Non-S/E		Part-Time		Full-Time Student		Seeking		Not Seeking	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Related Fields	255	147	57.6	16	6.3	23	9.0	13	5.1	9	3.5	47	18.4
Bachelor's	115	56	48.7	6	5.2	7	6.1	5	4.3	6	5.2	35	30.4
Master's	75	43	57.3	8	10.7	8	10.7	8	10.7	1	1.3	7	9.3
Ph.D.	65	48	73.8	2	3.1	8	12.3			2	3.1	5	7.7
Non-Related Fields	90	54	60.0	7	7.8	6	6.7	6	6.7	2	2.2	15	16.7
Bachelor's	46	29	63.0	4	8.7	4	8.7			1	2.2	8	17.4
Master's	31	15	48.4	2	6.4	1	3.2	6	19.4	1	3.2	6	19.4
Ph.D.	13	10	76.9	1	7.7	1	7.7					1	7.7

A more striking correlation seems to occur when the relative degree level of wife and husband are compared against her employment status. In this sample of 345 married women, 197 (57.1%) have the same highest degree level as their husbands. In 92 cases, (26.7%), the husband has a higher degree than the wife and in 56 cases (16.2%), her highest degree is higher than his. In the 161 cases where her highest degree is a bachelor's, we see a significant difference in her labor force participation depending upon the relative degree relationship of husband and wife (Table 5.9). Among those couples who are both at the bachelor's level, 20.7% of the women are non-students out of the labor force. When his degree is higher, 43.1% of the women are non-students out of the labor force, and when her degree is higher than his, all of the women are in the labor force. This same pattern exists at the master's level. When both husband and wife have a master's, 9.1% of the non-student women are out of the labor force. When he has a doctorate and she a master's, 23.5% of the women are out of the labor force, but when his degree is less than a master's, only 3.6% of the non-student women with a master's are out of the labor force.

TABLE 5.9

COMPARATIVE DEGREE LEVEL OF SPOUSES BY HER HIGHEST DEGREE AND HER EMPLOYMENT STATUS

Degree Level of Spouses by Her Highest Degree	TOTAL	HER EMPLOYMENT STATUS											
		EMPLOYED						NOT EMPLOYED					
		Full-Time S/E		Full-Time Non-S/E		Part-Time		Full-Time Student		Seeking		Not Seeking	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Same Degree Level													
Bachelor's	87	53	60.9	4	4.6	8	9.2	1	1.1	3	3.4	18	20.7
Master's	44	22	50.0	5	11.4	4	9.1	9	20.5			4	9.1
Ph.D.	66	48	72.7	2	3.0	9	13.6			2	3.0	5	7.6
His Degree Higher													
Bachelor's	58	19	32.7	5	8.6	2	3.4	4	6.9	3	5.1	25	43.1
Master's	34	17	50.0	5	14.7	2	5.9	1	2.9	1	2.9	8	28.5
Her Degree Higher													
Bachelor's	16	13	81.3	1	6.2	1	6.2			1	6.2		
Master's	28	19	67.9			3	10.7	4	14.3	1	3.6	1	3.6
Ph.D.	12	10	83.3	1	8.3							1	8.3

Most of the married doctorate women (91.7%) are married to men who also hold a doctorate and 92.3% of these women are in the labor force, regardless of the degree relationship of their husbands. However, the 12 women doctorates whose husbands hold less than a doctorate are more likely to be employed full-time in science and engineering than when both husband and wife have doctorates (83.3% and 72.7%). This might indicate fewer S/E employment opportunities.

Factors Adversely Affecting Career Development

One section of the questionnaire asked respondents to rate the degree of negative effect, if any, of a number of factors on the development of their careers. Each factor listed was to be rated on a scale ranging from little or no impact to major impact. Table 5.10 shows the number of women who indicated a moderate or major negative effect to each factor listed in this question.

The geographical location of jobs was noted as adversely affecting their career development by more women than checked any other single factor. This was paired with an almost equal number who noted unsatisfactory job opportunities. One fourth of the chemistry graduates and 30% of the engineering graduates cited one or both of these factors as having a negative impact of their career development.

TABLE 5.10

NUMBER CITING NEGATIVE IMPACT ON CAREER DEVELOPMENT, BY FACTOR

FACTOR	Chemistry	Engineering	Total
Employment Opportunities			
Geographical Location of Jobs	92	74	166
Unsatisfactory Job Opportunities	83	69	152
Travel Demands of Job	23	21	44
Family and Career			
Family demands on time	101	57	158
Young Children at Home	111	39	150
Demands of Husband's Career	76	35	111
Inadequate Household Help	64	22	86
Family Attitude Against Career	27	18	45
Discrimination			
Sex, race or Age Discrimination	61	63	124
Other			
Inadequate Funds for Education	33	39	72
Little Financial Incentive to Work	41	28	69
Personal Health	17	11	28
Friend's Attitude Against Career	4	8	12

A close second to employment opportunities in factors having a negative effect on career development were problems of combining a family and a career. Family demands on time, young children at home, and/or the demands of the husband's career are cited by 26% of the sample as having an adverse effect on their own career development. However, since 59% of the women in the sample are married and 36% have children, the demands of combining family and a career is not percieved as having a negative effect on career development by all of the mothers or even half of the married women.

One fifth of the sample said that sex, race or age discrimination had negatively affected their career development, including 17% of the chemistry graduates and 25% of the engineering graduates.

The questionnaire invited respondents to make additional comments if they wished to and 149 women did add comments - some extending to several pages. Many of these comments discuss the negative factors that have affected a career development; some noted positive factors and some were more general in nature.

The most frequently stated comment was that marriage and family responsibilities impeded career development. Some women accepted this impediment happily, feeling that the rewards of a family far outweighed the problems created in career development. However, the feeling expressed more often was summarized by one woman who said that "A woman should not have to be totally committed to either a child or a career."

Among the 42 women who commented on the negative effect of marriage and family responsibilities to career development, 35 were married and 30 had children. At the same time, three mothers also noted that marriage and children had not affected their career development in any negative way. Among the 42 who saw a negative relationship between family and career, 22 were employed (14 full-time and 6 part-time) and only two were employed outside science and engineering. Among the 20 who were not employed, three were graduate students, two were seeking employment, one held a postdoctoral appointment and 14 were out of the labor force because of family responsibilities.

Fifteen of the women noted that their husband's careers had in some way impeded their own career development. Among these women, seven specifically cited the geographical location of their husband's job as a negative factor, but only five were unemployed and among the ten who were employed, only one was employed outside of science and engineering.

Another frequently stated problem was that sex discrimination had been a major negative factor in their career development. The 27 women who spoke directly of the problem of sex discrimination either in their education or their working life were about equally divided in engineering and chemistry. One woman engineer, commenting on discrimination presently experienced in her job, pointed out the dichotomy faced by many women when she said, "Much to my chagrin, I often find myself praying that the right man will come along and take me away from all this."

A Ph.D. chemist noted that "the attitude of employers toward the advancement of their female employees is a highly negative factor in a woman's science career." A master's degree graduate in chemistry said that "for a woman, proving herself equally capable isn't good enough. She has to prove herself better in order to be accepted in a man's world." Another M.S. chemist voiced the same thought with "Women have to prove their worth, while men only have to prove their lack of worth."

Several women felt that the effects of the women's movement, affirmative action or EEO regulations were more negative than positive because opportunities given to women to be employed or to advance were seen as resulting from something other than her own merit. "I feel that tokenism hurts women in engineering. Women who are qualified in their jobs have had a hard time proving it to everyone else."

One master's level engineer spoke of the "negative effect" of her engineering education on her social environment and personal life, noting that "few men can really deal honestly with a threat to their 'macho'". The uneasiness that pervaded many of these comments relating to covert discrimination were summed up well by a woman engineer when she said "In my present position, I have found that my growth in career development has been hampered most by the prevailing attitudes of my supervisors and peers. They are less willing to trust, support and assume risks with a woman than with a man."

Although a number of women expressed their resentment at the sexism they had encountered, the only solution suggested was in effect to ignore it and expect that ultimately it would go away. One engineer said "I was tempted not to complete this questionnaire because I feel that the less special attention women seek, the sooner they will be accepted as people just doing what they like to do."

Several women referred indirectly to the special problems of women in a field dominated by men and several of them blamed these problems on the expectations of society and the passive and dependent role assigned to women by societal values. Half of the women who commented on this were doctorates. "This self-limiting expectation is a negative factor that must be overcome by constant internal struggle," one woman pointed out.

A few women commented that they had never experienced discrimination and that they felt women had the opportunity to do and become anything they wanted.

Several of the chemistry graduates were discouraged enough by lack of opportunity without an advanced degree to make special comments about this. Of the 11 women who commented on this problem, six were employed (four in science and engineering and two outside of those fields) and five were unemployed with three presently seeking jobs. Three of the 11 women had a master's degree but none had achieved a doctorate.

Within the total sample of 607 women, 166 checked the geographic location of jobs as having a negative impact in their career development, but only eight women made additional comments about the negative aspects of geographic location of jobs, and three of these women were single.

Although these unsolicited comments are generally concerned with negative factors, as would be expected, several women noted the positive influence of support from husband and family in their career development; some volunteered that they had never experienced sex discrimination either during their educational years or later on the job; and two stated that being a woman was an asset to career development during a period of heightened awareness of past sex discrimination. However, others felt that women were being hired and promoted because of equal opportunity rulings and that the final effect of these rulings would be negative in terms of accepting women individually on their own merit. Three women, all from Mount Holyoke, expressed their gratefulness for the quality of their education and the preparation for careers which was provided by their school.

Some women pointed out the need for more programs which would allow women to update their skills and several commented that the lack of part-time opportunities hastens the withdrawal of women from the labor force and delays their return, thus reinforcing the need for retraining. One woman suggested "return to the work force fellowships" to bridge the gap and others noted the need for "moderately priced" updating courses in science and engineering.

Summary

Responses from more than 600 women graduates of the past 15 years in chemistry and engineering strengthen the finding in other parts of this study that women trained in science and engineering are active participants in the national manpower pool of scientists and engineers, although some of them (about 13%) are temporarily out of the labor force improving their educational credentials; and an additional 10% are out for family and other reasons. Information from this latter group regarding plans for re-entry indicate that almost all of them have definite plans to return to work.

Their strong attachment to the labor force (including the high incidence of graduate preparation among the chemistry graduates in this sample), despite the discouragements involved in career/family conflicts, discrimination and a tight labor market indicates that these women and the many others who are like them will stay in science and engineering. If we are to increase the proportion of women working in science and technology, some consideration of the special problems of women, based on societal assignment of sex roles, seems merited.

More part-time job opportunities are needed in science and engineering to allow women to keep up their skills while participating in both career and family roles. This may become more important for men who wish to take a more active role in the early years of child raising. Several of these women express a present need for more retraining or updating programs geared toward re-entry into the labor force following a career break for family care.

Although many of them note a problem with the geographic location of jobs or the unsatisfactory job opportunities in their present location, this factor is not solely related to the geographical restrictions of marriage, since several of the single women also checked and commented on this factor as having a negative effect on their career development. Men may also have this problem.

Salaries available to women, particularly for several of the chemistry graduates, were seen as too low both by women who are working and some who are not. This problem related both to incentives to being in the labor force and to anger at the salary differentials between men and women with similar credentials. A check of salaries among those at all degree levels who are working full-time shows that 20% of these women earn less than $14,000 per year; and 34% of the chemistry graduates have earnings below this salary line.

Nonetheless, almost 65% of the mothers in this group of women are employed and an additional 10% are in graduate school.

The 600 women in this sample cannot be said to represent all women with degrees in these fields, or women with degrees in other science fields. But they do provide some insight to the dedication of women trained in science and engineering to utilizing their training in the labor force, and they have outlined some of the problems involved in that dedication.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Despite the problems and discouragements uniquely faced by women who seek to develop a career in science or engineering, more women than ever before are preparing themselves for careers in these fields and their proportionate increase is expected to continue.

Efforts by women's groups, Congress, government agencies, professional societies or others to encourage their increasing participation would benefit greatly by better information about these problems in order that efforts might be directed where they are most needed and resources appropriately divided. Such needs as better counseling for girls and women, removal of barriers to equal opportunity, provision of special programs or practices geared to the needs of reentry women and other actions require concurrent attention.

Need for Better Data

A valid, current statistical base is a first prerequisite for monitoring the progress and participation of women scientists and engineers. A major source for demographic information on scientists and engineers is data collected by the National Science Foundation. For a number of reasons, some of those data are incomplete in the information they provide about women scientists.

One significant reason for this is that the so-called Manpower Characteristics System (MCS) is a complex combination of statistical surveys which, like this study, takes pieces from a number of data sets and puts them together to present a statistical portrait of U.S. scientists and engineers. It is apparent from the revisions by NSF of the 1974 data (page 2) that this practice has not always been accurate in delineating the characteristics of women scientists and engineers, either in relation to each other or to their male cohorts.

The MCS was devised after 1970 in the wake of a sudden Congressional decision to eliminate the National Register - a longitudinal survey of scientists and some engineers that was carried out biennially from 1954 to 1970. The MCS was established without much thought being given to a systematic effort to obtain good statistical differentiation by sex and ethnic background, since these characteristics were not yet widely considered to be particularly important in 1970.

The MCS was supposed to reduce the cost of data collection, expand the coverage of the engineering population, and provide a representative sample of the science and engineering population to replace the incomplete register of scientists which had been established in the wake of World War II, both as a roster for locating important scientists in case of national need and as a statistical base for studying the scientific manpower of the United States. Funds to carry out statistical studies were then and are now limited by a number of considerations.

Increasing the size of the sample or the complexity of the analysis increases the cost. If sampling is to emphasize differentiation by sex or by ethnic background, the population must be over-sampled for women and minorities, because they are a small part of the total. If, on the other hand, other characteristics are considered more important to more users, such as fine field differentiation or a more thorough analysis of employment in research and development, then the sampling process and the cross tabulations chosen for analysis will be different. When any one characteristic is emphasized, another must be de-emphasized unless the funding is increased. Further, because the principal base of the MCS was selected through the 1970 Census, a shift in emphasis was difficult to accomplish over the ensuing decade.

The number of questions that can be asked in any survey, and the cross-tabulations of responses to questions that can be made also are limited by the availability of funds. Some trade-offs are inevitable, and the resultant "incomplete" information will be less detailed and less useful for some statistical purposes than for others.

Nonetheless, the extreme data variance obtained by NSF in its two analyses of the characteristics of women scientists and engineers in 1974, (Tables 1.1 and 1.2, pages 2 and 3), based on the same data from the same surveys, indicates that the survey instruments, the sampling techniques, and the analytical procedures used to obtain the resultant data need to be changed over the next decade to place more emphasis on accurate differentiation of the characteristics of U.S. scientists and engineers by sex. Only when an accurate and complete statistical picture of the participation of women in science and engineering is available, can progress be measured from a known point.

RECOMMENDATION

IN PLANNING THE METHODOLOGY FOR COLLECTING, ANALYZING AND REPORTING DATA ON SCIENTISTS AND ENGINEERING DURING THE COMING DECADE, GREATER EMPHASIS SHOULD BE PLACED ON OBTAINING ACCURATE AND RELIABLE STATISTICS ABOUT WOMEN, EVEN IF THIS REQUIRES LESS EMPHASIS ON OTHER DATA NEEDS.

This will require some change in sampling techniques, in survey instruments and in analytical procedures, not only for the surveys used to compile the Manpower Characteristics System but also in such surveys as the biennial survey of scientists and engineers employed at academic institutions.

Removing Other Barriers

In addition to improving its statistics on women in science and engineering, NSF is uniquely in a position to encourage change in some of the practices and policies that act as barriers to women. NSF can support pilot programs to develop new curricula for updating or retraining; programs which will provide better and more usable supply and demand information for students and others who need it in order to make informed career choices; and incentives to encourage part-time employment opportunities. NSF should also consider the validity of providing financial assistance for part-time study.

Updating and Retraining Programs

As the population of 18-year-olds continues to drop, academic institutions will have increasing opportunity and challenge to plan and carry out special educational programs for reentry women, not only in science and engineering but also in other areas of academic concentration. Many women will wish to take some time from the labor force to have children and to care for them, particularly during their pre-school years. The kinds of academic courses in science and engineering presently available do not generally fit the needs of women or men who want to reenter the labor force after a few years away.

Further, the oversupply of college graduates in some areas of science results in a shortage of employment opportunities, while other areas of expertise are continuously in demand. More special programs geared to retrain persons with science backgrounds in areas of current or projected demand also are needed.

RECOMMENDATION

THE NATIONAL SCIENCE FOUNDATION SHOULD ENCOURAGE AND SUPPORT THE DEVELOPMENT OF PILOT PROGRAMS DESIGNED TO UPDATE INFORMATION AND REINFORCE RUSTY SKILLS OF PERSONS PREVIOUSLY TRAINED IN SCIENCE AND ENGINEERING; AS WELL AS PROGRAMS TO RETRAIN SUCH PERSONS IN FIELDS SUCH AS COMPUTER SCIENCES, WHERE EMPLOYMENT OPPORTUNITIES ARE GOOD.

Providing Supply and Demand Information

Accurate information is essential to the process of making informed choice. Students at both undergraduate and graduate levels, as well as women seeking to enter or reenter the labor force need to know as much as possible about the present and projected job market in science and engineering in order to decide such questions as which field or subfield they choose to specialize in; whether and when to enter or continue graduate education, and whether to make any shift in field choice; whether to update rusty skills and knowledge in an earlier field of study or to seek retraining in a peripheral field where job opportunities are different.

Students and former students of both sexes are generally poorly informed about specific areas of science or engineering which are now or are expected to be over-supplied or under-supplied.

Few counselors at either high school or college levels are fully informed about the job market in science and engineering, except in a very broad sense. The supportive women's groups which have sprung up over the past decade to offer counseling for reentry women also need much better informational materials about the science and engineering job market than are presently available, in order to carry out their functions most effectively.

Career guidance materials in science and engineering are prepared and distributed by many professional societies as well as profit-making publishers such as Chronicle Guidance Publications. But materials comparing and contrasting opportunities in various areas of science and engineering are rare and are needed.

RECOMMENDATION

NSF SHOULD ENCOURAGE AND SUPPORT THE PREPARATION AND WIDE DISSEMINATION OF MATERIALS (PAMPHLETS, FILMS, ETC.) DESIGNED TO PROVIDE ACCURATE, CURRENT INFORMATION ABOUT PRESENT AND PROJECTED JOB OPPORTUNITIES IN THE VARIOUS FIELDS AND SUBFIELDS OF SCIENCE AND ENGINEERING,FOR USE BY STUDENTS, FORMER STUDENTS, COUNSELORS AND PARENTS.

Financial Assistance for Part-Time Study

Traditionally, fellowships and traineeships in science and engineering, as well as most other kinds of financial aid have been restricted to those persons who devote full-time to graduate study. Such full-time commitment is not possible for some women who would otherwise be fully qualified to compete for such awards.

RECOMMENDATION

NSF SHOULD CONSIDER AND TEST THE VALIDITY OF PROVIDING FINANCIAL ASSISTANCE FOR PART-TIME STUDY.

Opportunities for Part-Time Employment

Part-time employment opportunities in science and engineering are relatively rare outside of academic institutions. In some instances this is because the traditionally male science and engineering population has not needed or wanted many part-time opportunities. However, the availability of part-time jobs would allow more women to continue their work while their children were young, and would hasten the reentry to the labor force of others following a career break for child rearing. More part-time job opportunities for women would reduce some of the need for retraining or updating. Such opportunities also would be beneficial for men who want to take a larger share in the rearing of their children during pre-school years.

RECOMMENDATION

EMPLOYERS SHOULD EXAMINE THEIR POLICIES AND PRACTICES REGARDING PART-TIME EMPLOYMENT IN SCIENCE AND ENGINEERING, AND BE ENCOURAGED TO PROVIDE PART-TIME EMPLOYMENT OPPORTUNITIES WHEREVER POSSIBLE.

APPENDIX

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NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

Dear Graduate:

We need your help in a major national study of the occupational experiences of recent college graduates in Science and Engineering. This project, sponsored by the National Science Foundation will obtain information from a scientifically chosen sample of 16,000 persons who earned Bachelor's or Master's degrees between July 1, 1973 and June 30, 1975. You are one of those chosen to be in this study.

The purpose of this study is to compile national statistics which will allow an appraisal of the employment and educational characteristics of scientists and engineers graduating since 1973. The resulting information will permit the Federal Government, universities and others to formulate science policies and programs and to make evaluations with regard to the science and engineering manpower potential of the nation.

The questionnaire on the following pages will take about 10-15 minutes of your time to complete, and a postage-paid envelope addressed to Westat, Inc. is enclosed for its return. Westat, Inc. has been selected by the National Science Foundation to assist in carrying out this survey.

We wish you to know that your completed questionnaire will be seen only by the immediate research staff and will be used for statistical purposes only. In compliance with the Privacy Act of 1974, no personally identifying information will be released to anyone.

We think you will find it interesting and invite your comments on the questionnaire items. In addition, if you have any questions on the survey or need any assistance in completing the questionnaire, please call (collect) Mr. Mark Waksberg or Mr. George K. Schueller at (301) 881-5310.

It would be of great help if you would complete and return the questionnaire within the next five days. If possible, we suggest that you do it now, while you have it in hand. We believe the importance of the study will justify the time you give to it.

The National Science Foundation would greatly appreciate your cooperation in this survey.

Very truly yours,

Charles E Falk

Charles E. Falk, Director
Division of Science Resources Studies

1976 NATIONAL SURVEY OF RECENT SCIENCE AND ENGINEERING GRADUATES
NATIONAL SCIENCE FOUNDATION

DEGREE AND EMPLOYMENT SPECIALTY LIST

Use this list for Questions 5 and 9. Find the number corresponding to the appropriate major field and mark it in the space provided in the questionnaire.

BIOLOGICAL SCIENCE

01 Agriculture, all fields
02 Anatomy and histology
03 Bacteriology
04 Biochemistry
05 Biology (general)
06 Biophysics
07 Botany, horticulture, plant pathology
08 Entomology
09 Forestry, all kinds
10 Genetics
11 Immunology
12 Marine/animal or life science
13 Microbiology
14 Physiology
15 Zoology
16 Other biological science

ENGINEERING

17 Aeronautical, aerospace, astronautical
18 Agricultural
19 Architectural
20 Chemical
21 Civil
22 Electrical or electronic
23 Environmental, sanitary
24 General
25 Industrial
26 Mechanical
27 Metallurgical, material
28 Mining, geol., petro.
29 Nuclear
30 Operations research, systems
31 Technology
32 Other engineering

PHYSICAL SCIENCE MATHEMATICS

33 Astronomy
34 Atmospheric science (meteorology)
35 Chemistry
36 Computer science and data processing
37 Earth science (geology, geophysics)
38 Geography
39 Mathematics
40 Oceanography
41 Physics
42 Statistics
43 Other physical sciences

SOCIAL SCIENCE

44 Anthropology
45 Economics, all fields
46 Linguistics
47 Political science (incl. government, international relations)
48 Public administration
49 Psychology (all fields except clinical)
50 Social work, all fields
51 Sociology
52 Other social science

ARTS AND HUMANITIES

53 Art, fine and applied
54 English (language and literature)
55 Foreign language and literature
56 History
57 Journalism, all fields
58 Music, all fields
59 Philosphy, all fields

BUSINESS

60 Accounting
61 Business Administration (general)
62 Finance
63 Marketing and sales
64 Management, all fields
65 Secretarial studies
66 Other business

EDUCATION

67 Art or music
68 Biological sciences
69 Business
70 Elementary
71 Mathematics
72 Physical education or recreation
73 Physical sciences
74 Secondary
75 Science education, other
76 Special education
77 Other education

PROFESSIONS, TECHNICAL FIELDS

78 Architecture or urban planning
79 Clinical psychology
80 Dentistry
81 Drafting or design, all fields
82 Home economics
83 Health technology (med., dental or lab.
84 Law or pre-law
85 Library or archival science
86 Medicine or pre-medicine
87 Nursing
88 Pharmacy
89 Religion
90 Other health professions
91 Other

OTHER

92 Building trades
93 Communications (radio, T.V.)
94 Crafts (skilled), all fields
95 Law enforcement
96 Machine operation
97 Military science
98 Other, not elsewhere classified
99 Undecided

OMB No. 99-S76003
Expires: December 1976

1976 SURVEY OF RECENT SCIENCE AND ENGINEERING GRADUATES
NATIONAL SCIENCE FOUNDATION

1. Date of Birth

☐☐☐ Mo. Day Year

2. Citizenship

USA . . . 1 ☐
Non-USA . 2 ☐
(Specify country_____

______________)

3. Sex

Male ☐
Female ☐

4. Race/Ethnic Identification:

White/Caucasian . 1 ☐
Black/Negro/or Afro-American . 2 ☐
American-Indian . 3 ☐
Mexican-American/ Chicano . . . . 4 ☐
Puerto Rican/ American. . . . . 5 ☐
Oriental. . . . . 6 ☐
Other Asian . . . . 7 ☐
Other (Specify) . . 8 ☐

____

5. List in the table below all undergraduate and graduate degrees, excluding honorary degrees, than have been awarded to you. Please use Specialty List on Page 2 for major field and number.

Type of Degree	Granted		Major Field (Use Specialties List)	
	Month	Year	Name	Number
Bachelor's				
Masters				
Doctorate				

PLEASE NOTE that in items 6-14a, information is requested for the current year as of the week of June 7, 1976

6. What was your employment status as of the period indicated? (CHECK ONLY ONE CATEGORY.)

Employed full-time, science or engineering related positions . . 1 ☐ Go to 7
Employed full-time, nonscience or nonengineering related position . 2 ☐ Go to 6a
Employed part-time, science or engineering related position. . . 3 ☐ Go to 6b
Employed part-time, nonscience or nonengineering related position . 4 ☐ Go to 6b
Postdoctoral appointment (fellowship, traineeship, research associateship, etc.). . . . . . . 5 ☐ Go to 7
Unemployed and seeking employment . 6 ☐ Go to 15
Unemployed and not seeking employment. . . . . 7 ☐ Go to 15
Retired and not employed. . . . . . 8 ☐ Go to 15
Other (Specify): ______________ 9 ☐ Go to 15

6a. If you were employed full-time during the week of June 7, 1976, in a position unrelated to science or engineering, what was the MOST important reason for taking the position?

Prefer nonscience or nonengineering position. . . . . 1 ☐
Promoted out of science or engineering position. . . . . . . 2 ☐
Pay is better . . . . 3 ☐
Locational preference . . . . 4 ☐
Science or engineering position not available . . . . 5 ☐
Other (Specify): ______________ 6 ☐
} Go to Q. 7

6b. If you were employed part-time during the week of June 7, 1976, were you seeking full-time employment?

Yes . . . 1 ☐ No . . . 2 ☐

7. Which category below best describes the type of organization of your principal employment? (CHECK ONLY ONE CATEGORY.)

Business or industry . . . . 1 ☐
Junior college, 2-year college, technical institute. . . . . 2 ☐
Medical school . . . . 3 ☐
Four-year college or university other than medical school. . . . . 4 ☐
Elementary or secondary school system. . . 5 ☐
Hospital or clinic . . . . 6 ☐
U.S. military service, active duty, or Commissioned Corps, e.g., UPHS, NOAA . . 7 ☐
U.S. government, civilian employee . . . . 8 ☐
State government . . . . 9 ☐
Local or other government. . . . . .10 ☐
(Specify): ______________
International agency . . . . .11 ☐
Non-profit organization, other than hospital, clinic or educational institution. . . . . .12 ☐
Other (Specify): ______________ 88 ☐

8. What was the primary (A) and secondary (B) work activity related to your position? (CHECK ONLY ONE BOX IN EACH COLUMN.)

		A	B
Management or administration of:			
Research and development.	1	☐	☐
Other than research & development . .	2	☐	☐
Both.	3	☐	☐
Basic research.	4	☐	☐
Applied research.	5	☐	☐
Development of equipment, products, systems data.	6	☐	☐
Design.	7	☐	☐
Teaching.	8	☐	☐
Report or other technical writing, editing	9	☐	☐
Production.	10	☐	☐
Consulting (Specify): ______________	11	☐	☐
Professional services to individuals.	12	☐	☐
Quality control, inspection, testing.	13	☐	☐
Sales, marketing, purchasing, estimating.	14	☐	☐

Other (Specify)

9. From the Degree and Employment Specialties List on Page 2, select and enter both the number and title of the specialty most closely related to your principal employment. Write in your specialty if it is not on the list.

____

Number Type of Specialty

10. What percent of time did you devote to each of the following activities?

	Percent
Management or administration of: Research and development.	______
Other than research and development	______
Basic research.	______
Applied research.	______
Development	______
Design.	______
Teaching.	______
Consulting.	______
Production.	______
Other (Specify): ________________	______
TOTAL	100%

11. Please give the name of your principal employer (organization, company, etc., or, if self-employed write "self"), and actual place of employment.

____
Name of Employer

____
City State Zip Code

12. What was the basic annual salary* associated with your principal professional employment during the week of June 7, 1976 ?

$____________________per year.

*NOTE: Basic annual salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work.

If academically employed:

a. Check whether salary was for 9-10 months ☐ or 11-12 months ☐ .

b. What was the title of your position?

Professor . . . . 1 ☐
Associate Professor . . . . 2 ☐
Assistant Professor . . . . 3 ☐
Instructor. . . . . 4 ☐
Lecturer. . . . . 5 ☐
Teaching Assistant. . . . . 6 ☐
Research Assistant. . . . . 7 ☐
Other (Specify): ____________________ 8 ☐

____

Does not apply. . . . . 9 ☐

13. Listed below are selected topics of critical national interest. If you devoted a significant proportion of your professional time to any of these problem areas in the week of June 7, 1976, please check the box for the on on which you spent the MOST time.

Education:
  Teaching. . . . . 1 ☐
  Other . . . . 2 ☐
Health. . . . . 3 ☐
Defense . . . . 4 ☐
Environmental protection, pollution
  control . . . . 5 ☐
Space . . . . 6 ☐
Crime prevention and control. . . . . . . 7 ☐
Food production and technology. . . . . . 8 ☐
Energy and fuel . . . . 9 ☐
Other mineral resources . . . . .10 ☐
Community development and services. . . .11 ☐
Housing (planning, design, construction).12 ☐
Transportation. . . . . .13 ☐
Other (Specify): ____________________ 88
None of the above . . . . .14 ☐

14. Was any of your work in the week of June 7, 197 supported by U.S. Government funds?

Yes. . . . . 1 ☐ Go to 14
No . . . . 2 ☐ } Go to 1
Don't Know . . . . 3 ☐ }

12(

14a. If yes, which of the following Federal agencies or departments were supporting the work? (CHECK ALL THAT APPLY.)

NASA . . . . 31 ☐
National Science Foundation. . . . . 32 ☐
Environmental Protection Agency. . . . . . 33 ☐
Energy Research and Development
  Administration (AEC) . . . . 34 ☐
Nuclear Regulatory Commission. . . . . . . 35 ☐
Agency for International Development . . . 36 ☐
Department of Interior . . . . 37 ☐
National Institutes of Health, HEW . . . . 38 ☐
Alcohol, Drug Abuse and Mental Health
  Administration, HEW. . . . . 39 ☐
Office of Education, HEW . . . . 40 ☐
Other HEW, (Specify): ________________ 41 ☐

____

Department of Defense. . . . . 42 ☐
Department of Commerce . . . . 43 ☐
Department of Agriculture. . . . . 44 ☐
Department of Transportation . . . . 45 ☐
Department of Justice. . . . . 46 ☐
Department of Housing and Urban
  Development. . . . . 47 ☐
Other agency or department (Specify): 48 ☐

____

Don't know source agency . . . . 49 ☐

15. How many years of professional work experience, including teaching, have you had? (Professional experience includes those work activities in which you have been engaged requiring knowledge of your field at the baccalaureate or equivalent background.)

________________ Years

16. Which of the following best describes your current enrollment status? (MARK ONE ONLY.)

Not a student. . . . . 1 ☐
Graduate student (post baccalaureate):
  Full-time. . . . . 2 ☐
  Part-time. . . . . 3 ☐

THANK YOU FOR YOUR COOPERATION. PLEASE RETURN THE COMPLETED QUESTIONNAIRE IN THE ENCLOSED POSTAGE PAID ENVELOPE.

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

August 1978

Dear Graduate:

We need your help in a major national study of the occupational experiences of graduates in Science and Engineering who have been in the labor market for several years. This project, sponsored by the National Science Foundation and the U.S. Department of Energy, will obtain information from a scientifically chosen sample of 13,000 persons who earned Bachelor's or Master's degrees between July 1, 1971 and June 30, 1972. The sample consists of graduates in engineering and natural, physical, or social science. You are one of those chosen to be in this study.

The purpose of this study is to compile national statistics which will allow an appraisal of the employment and educational characteristics of scientists and engineers graduating in 1971/72.

The resulting information will permit the Federal Government, universities and others to formulate science policies and programs and to make evaluations with regard to the science and engineering manpower potential of the nation.

The questionnaire on the following pages will take about 10-15 minutes of your time to complete, and a postage-paid envelope addressed to Westat, Inc. is enclosed for its return. Westat, Inc. has been selected by the National Science Foundation to assist in carrying out this survey.

We wish you to know that your completed questionnaire will be seen only by the immediate research staff and will be used for statistical purposes only. In compliance with the Privacy Act of 1974, no personally identifying information will be released to anyone.

We think you will find it interesting and invite your comments on the questionnaire items. In addition, if you have any questions on the survey or need any assistance in completing the questionnaire, please call (collect) Mr. Mark Waksberg or Mr. George K. Schueller at (301) 881-5310.

It would be of great help if you would complete and return the questionnaire within the next five days. If possible, we suggest that you do it now, while you have it in hand. We believe the importance of the study will justify the time you give to it.

The National Science Foundation and the U.S. Department of Energy would greatly appreciate your cooperation in this survey.

Very truly yours,

Charles E Falk

Charles E. Falk, Director
Division of Science Resources Studies

This information is solicited under the authority of the National Science Foundation Act of 1950, as amended. All information you provide will be treated as confidential and will be used for statistical purposes only. Information will be released only in the form of statistical summaries from which it will be impossible to identify information about any particular person. Your response is entirely voluntary and your failure to provide some or all of the requested information will in no way adversely affect you.

1978 SURVEY OF RECENT SCIENCE AND ENGINEERING GRADUATES

NATIONAL SCIENCE FOUNDATION AND THE U.S. DEPARTMENT OF ENERGY

DEGREE AND EMPLOYMENT SPECIALTY LIST

Use this list for questions 8 and 15. Find the number corresponding to the appropriate major field and mark it in the space provided in the questionnaire.

AGRICULTURAL SCIENCE

001 Agronomy
002 Animal/Dairy/Poultry Science
003 Horticulture
004 Range Management
005 Forestry
006 Other Agricultural Sciences

BIOLOGICAL SCIENCE

007 Anatomy and Histology
008 Bacteriology
009 Biochemistry
010 Biology, General
011 Biophysics
012 Botany, Plant Pathology
013 Entomology
014 Genetics
015 Immunology
016 Marine Science
017 Microbiology
018 Physiology
019 Zoology
020 Nutrition (excluding Home Economics)
021 Pharmacology
022 Other Biological Science

ENGINEERING

023 Aeronautical, Aerospace, Astronautical
024 Agricultural
025 Architectural
026 Ceramic
027 Chemical
028 Civil
029 Electrical or Electronic
030 Environmental, Sanitary
031 General
032 Geological
033 Industrial
034 Mechanical
035 Metallurgical, Materials
036 Mining
037 Nuclear
038 Operations Research, Systems
039 Petroleum
040 Technology (Bachelor's level)
041 Other Engineering

PHYSICAL SCIENCE, MATHEMATICAL SCIENCE

042 Astronomy
043 Atmospheric Science (Meterology)
044 Chemistry
045 Computer Science and Data Processing
046 Earth Science (Geology, Geophysics)
047 Geography
048 Mathematics
049 Oceanography
050 Physics
051 Statistics
052 Other Physical Sciences

SOCIAL SCIENCE

053 Anthropology
054 Economics, all fields
055 Linguistics
056 Political Science (including Government, International Relations)
057 Public Administration
058 Psychology (all fields except Clinical)
059 Social Work, all fields
060 Sociology
061 Criminology
062 Urban Studies
063 Other Social Science

ARTS AND HUMANITIES

064 Art, Fine and Applied
065 English (Language and Literature)
066 Foreign Language and Literature
067 History
068 Journalism, all fields
069 Music, all fields
070 Philosophy, all fields
071 Other Arts and Humanities

BUSINESS

072 Accounting
073 Business Administration, General
074 Finance
075 Marketing and Sales
076 Management, all fields
077 Secretarial Studies
078 Other Business

EDUCATION

079 Art or Music Education
080 Biological Science Education
081 Business Education
082 Elementary Education
083 Engineering Education
084 Mathematics Education
085 Physical Education or Recreation
086 Physical Sciences Education
087 Secondary Education
088 Science Education, Other
089 Special Education
090 Other Education

OTHER PROFESSIONS, TECHNICAL FIELDS

091 Architecture or Urban Planning
092 Clinical Psychology
093 Drafting or Design, all fields
094 Home Economics
095 Health Technology (Medical, Dental, Lab)
096 Dentistry
097 Medicine or Pre-Medicine
098 Nursing
099 Pharmacy
100 Other Health Professions
101 Law or Pre-Law
102 Library or Archival Science
103 Religion
104 Other

OTHER

105 Building Trades
106 Communications (Radio, TV)
107 Crafts (Skilled), all fields
108 Law Enforcement
109 Machine Operation
110 Military Science
111 Other, not elsewhere classified

OMB NO. 99S - 78016
Expires March 1979

1978 SURVEY OF RECENT SCIENCE AND ENGINEERING GRADUATES

NATIONAL SCIENCE FOUNDATION AND THE U.S. DEPARTMENT OF ENERGY

1. Date of Birth

☐☐☐
Mo. Day Year

2. Citizenship

USA .... 1 ☐
Non-USA .... 2 ☐
(Specify country): ______

3. Sex

Male 1 ☐
Female 2 ☐

4. What is your racial background?

American Indian or Alaska native .... 1 ☐
Asian or Pacific Islander. 2 ☐
Black .... 3 ☐
White .... 4 ☐

4a. Is your ethnic heritage Hispanic?

Hispanic origin ... 1 ☐
Not of Hispanic origin ... 2 ☐

5. What is your marital status?

Single, never married .... 1 ☐ *Go to 6*
Separated, divorced, or widowed .... 2 ☐
Married .... 3 ☐

5a. Do you have any children?

No .. 1 ☐ Yes, under age 6 .... 2 ☐ Yes, 6 years of age or over .... 3 ☐

6. Are you physically handicapped?

Yes ..... 1 ☐ No ..... 2 ☐ *Go to 7*

6a. What is the nature of your handicap(s)? *(Mark as many as apply.)*

Visual .... 1 ☐
Auditory .... 2 ☐
Orthopedic .... 3 ☐
Other *(Specify)*: ______ 4 ☐

7. Which of the following best describes your enrollment status as of the week of August 7, 1978? *(Mark one only.)*

Not a student .... 1 ☐
Graduate student (post baccalaureate)
  Full-time .... 2 ☐
  Part-time .... 3 ☐
Undergraduate student .... 4 ☐

8. List in the table below all undergraduate and graduate degrees, excluding honorary degrees, that have been awarded to you. Please use Specialty List on page 2 for major field and number.

Type of Degree	Granted		Major Field (Use Specialty List)	
	Month	Year	Name	Number
Bachelor's				
Master's				
Doctorate				
Other *(Specify)*				

9. How many years of professional work experience, including teaching, have you had? (Professional experience includes those work activities in which you have been engaged requiring knowledge of your field at the baccalaureate or equivalent background.)

Years ...... ☐

PLEASE NOTE that in items 10-22 information is requested for the current year as of the week of August 7, 1978.

10. What was your employment status as of the period indicated? *(Check only ONE category.)*

Employed full-time, science or engineering-related position .... 1 ☐ *Go to 11*
Employed full-time, nonscience or nonengineering-related position ..... 2 ☐ *Go to 10a*
Employed part-time, science or engineering-related position .... 3 ☐ *Go to 10b*
Employed part-time, nonscience or nonengineering-related position ..... 4 ☐ *Go to 10b*
Postdoctoral appointment (fellowship, traineeship, research associateship, etc.) .... 5 ☐ *Go to 11*
Unemployed and seeking employment ..... 6 ☐ *Go to 10c and 10d*
Not employed and not seeking employment .... 7 ☐ *Go to 10e*
Retired and not employed .... 8 ☐ *Go to 23*
Other *(Specify)*: ______ 9 ☐ *Go to 11*

10a. If you were employed full-time during the week of August 7, 1978, in a position unrelated to science or engineering, what was the MOST important reason for taking the position?

Prefer nonscience or nonengineering position .... 1 ☐
Promoted out of science or engineering position .... 2 ☐
Pay is better .... 3 ☐
Locational preference .... 4 ☐
Science or engineering position not available .... 5 ☐
Other *(Specify)*: ______ 6 ☐
Go to 11

10b. If you were employed part-time during the week of August 7, 1978, were you seeking full-time employment?

Yes ..... 1 ☐ No ..... 2 ☐ *Go to 11*

10c. If you were unemployed and seeking employment during the week of August 7, 1978, was your job search restricted by:

Geographic location .... 1 ☐
Family responsibilities .... 2 ☐
Need for part-time employment .... 3 ☐
Other *(Specify)*: ______ 4 ☐

10d. How many weeks, during the period of unemployment ending with the week of August 7, 1978, were you unemployed and seeking work?

Weeks ...... ☐ *Go to 23*

10e. If you were not employed and not seeking work during the week of August 7, 1978, what was the most important reason for not seeking work?

Full-time graduate student .... 1 ☐
Temporarily absent for health or personal reasons .... 2 ☐
Tending to family responsibilities .. 3 ☐
Could not find work or believed no job available in my field .... 4 ☐
Insufficient financial incentive .... 5 ☐
On layoff .... 6 ☐
Other *(Specify)*: ____________________ 7 ☐

Go to 23

11. Which category below best describes the type of organization of your principal employment during the week of August 7, 1978? *(Check only ONE category.)*

Business or industry .... 01 ☐
Junior college, 2-year college, technical institute .... 02 ☐
Medical school .... 03 ☐
Four-year college or university other than medical school .... 04 ☐
Elementary or secondary school system .... 05 ☐
Hospital or clinic .... 06 ☐
U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA ...... 07 ☐
U.S. government, civilian employee .... 08 ☐
State government .... 09 ☐
Local or other government *(Specify)*: .... 10 ☐
____
International agency .... 11 ☐
Nonprofit organization, other than hospital, clinic, or educational institution .... 12 ☐
Other *(Specify)*: ____________________ 13 ☐

12. Please give the name of your principal employer (organization, company, etc., or if self-employed, write "self"), and actual place of employment during the week of August 7, 1978.

____
Name of Employer

____
City **State**

13. What percent of working time did you devote to each of the following activities during the week of August 7, 1978?

	Percent	
Management or administration of research and development	______	01
Management or administration of other than research and development	______	02
Teaching and training -- preparing and teaching courses, guiding and counseling students or trainees	______	03
Basic research	______	04
Applied research	______	05
Development -- product, process, and technical development	______	06
Report and technical writing, editing, information retrieval	______	07
Clinical diagnosis	______	08
Design -- of equipment, processes, models	______	09
Quality control, testing, evaluation, or inspection	______	10
Operations -- production, maintenance, construction, installation	______	11
Distribution -- sales, traffic, purchasing, customer and public relations	______	12
Statistical work -- survey work, forecasting, statistical analysis	______	13
Consulting	______	14
Computer applications	______	15
Other activities *(Specify)*: ______________	______	16
______________________	______	
Total	100%	

14. Among all the activities marked above, which was your primary and which was your major secondary activity? *(Fill in the appropriate code numbers -- 01 to 16 -- from Q. 13.)*

Primary work activity .... ☐☐
Major secondary work activity ...... ☐☐

15. From the Degree and Employment Specialties List on page 2, select and enter both the number and title of the specialty most closely related to your principal employment during the week of August 7, 1978. Please write in your specialty if it is not on the list.

Number	Type of Specialty

16. What was the basic annual salary* associated with your principal professional employment during the week of August 7, 1978?

$ ______ per year

*NOTE: *Basic annual salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work.*

16a. Were you academically employed?

Yes ...	1	☐	*Go to 16b and 16c*
No	2	☐	*Go to 17*

16b. Check whether salary was for:

9-10 months	1	☐
11-12 months	2	☐

16c. What was the title of your position?

Professor	1	☐
Associate professor	2	☐
Assistant professor	3	☐
Instructor	4	☐
Lecturer	5	☐
Teaching assistant	6	☐
Research assistant	7	☐
Other *(Specify)*: ______	8	☐

17. Was any of your work in the week of August 7, 1978 supported by U.S. government funds?

Yes ...	1	☐	*Go to 17a*
No	2	☐	*Go to 18*
Don't know..	3	☐	

17a. IF YES to 17, which of the following federal agencies or departments were supporting the work? *(Check all that apply.)*

Agency for International Development	01	☐
Environmental Protection Agency	02	☐
National Aeronautics and Space Administration	03	☐
National Endowment for the Arts	04	☐
National Endowment for the Humanities	05	☐
National Science Foundation	06	☐
Nuclear Regulatory Commission	07	☐
Smithsonian Institution	08	☐
Department of Agriculture	09	☐
Department of Commerce	10	☐
Department of Defense	11	☐
Department of Energy	12	☐
Department of Health, Education, and Welfare:		
National Institutes of Health	13	☐
Alcohol, Drug Abuse, and Mental Health Administration	14	☐
National Institutes of Education	15	☐
Office of Education	16	☐
Other *(Specify)*: ______	17	☐
Department of Housing and Urban Development ..	18	☐
Department of the Interior	19	☐
Department of Justice	20	☐
Department of Labor	21	☐
Department of State	22	☐
Department of Transportation	23	☐
Other agency or department *(Specify)*:	24	☐
Don't know source agency	25	☐

18. Listed below are selected topics of critical national interest. If you devoted a significant proportion of your professional time to any of these problem areas in the week of August 7, 1978, please check the box for the ONE on which you spent the MOST time.

Energy and fuel	01	☐	*Go to 19*
Health	02	☐	*Go to 23*
Defense	03	☐	
Environmental protection, pollution control	04	☐	
Education	05	☐	
Space	06	☐	
Crime prevention and control	07	☐	
Food and other agricultural products	08	☐	
Natural resources, other than fuel or food	09	☐	
Community development and services ..	10	☐	
Housing (planning, design, construction)	11	☐	
Transportation, communications	12	☐	
Cultural life	13	☐	
Other area *(Specify)*: ______	14	☐	
Does not apply	88	☐	

19. Please check your best estimate of the percent of your professional time during the week of August 7, 1978 that was devoted to energy and fuel.

100 percent .... 1 ☐
75 to 99 percent .... 2 ☐
50 to 74 percent .... 3 ☐
25 to 49 percent .... 4 ☐
24 percent or less .... 5 ☐

20. From the list below, check the ONE energy source that involved the LARGEST proportion of your energy-related work during the week of August 7, 1978.

Coal and coal products .... 01 ☐
Petroleum (including oil shale and tar sands) .... 02 ☐
Natural gas .... 03 ☐
Fission .... 04 ☐
Fusion .... 05 ☐
Hydroenergy .... 06 ☐
Direct solar (including space and water heating, thermal, electric) .... 07 ☐
Indirect solar (winds, tides, biomass, etc.).. 08 ☐
Geothermal .... 09 ☐
Other *(Specify)*: ______________________________ 10 ☐

21. Please read the following list of energy-related activities and check the item(s) that best describe the activity(ies) in which you were engaged during the week of August 7, 1978. *(Check all that apply.)*

Exploration .... 01 ☐
Extraction (gas, oil, mining) .... 02 ☐
Manufacture of energy-related components or products .... 03 ☐
Fuel processing (including refining and enriching) .... 04 ☐
Electric power generation .... 05 ☐
Transportation, transmission, distribution of fuel or energy .... 06 ☐
Energy storage .... 07 ☐
Energy utilization, management .... 08 ☐
Fuel reprocessing or disposal .... 09 ☐
Energy conservation .... 10 ☐
Environmental impact (health, economic, etc.).. 11 ☐
Education, training .... 12 ☐
Other *(Specify)*: ______________________________ 13 ☐

22. Please enter the number of the activity from the above list that best describes the activity in which you spent most of your energy-related time. *(Fill in the appropriate code numbers -- 01 to 13 -- from Q. 21.)*

☐☐

23. Thank you for completing this questionnaire. Please return the completed form in the enclosed postage-paid envelope.

If you have any comments on the content of this questionnaire, please state them here.

FOLLOW UP SURVEY OF 1961 FRESHMEN WHO, WHEN SURVEYED IN 1971, HAD ATTAINED NO HIGHER DEGREE THAN A BACHELOR'S

Higher Education Research Institute

THE FOLLOW-UP SURVEY INSTRUMENT

DIRECTIONS: Your responses will be read by an optical mark reader. Your careful observance of these few simple rules will be most appreciated.

- Use only black lead pencil (No. 2 or less).
- Make heavy black marks that fill the circle.
- Erase cleanly any answer you wish to change.
- Make no stray markings of any kind.

EXAMPLE:

Will marks made with ball pen or fountain pen be properly read? Yes . ○ No . ●

1. Since you received your bachelor's degree, how many courses have you taken for graduate credit? (Mark one)

○ None ○ 1–3 ○ 4 or more

2. What is the highest degree you now hold? (Mark one)

○ Bachelor's
○ Master's
○ Doctorate or equivalent advanced degree (Ph.D., M.D., D.D.S., D.V.M., LL.B., etc.)

3. Using the following list of study areas, provide answers in columns A, B, and C as indicated:

Ⓐ In which area did you take the most courses for your undergraduate degree? (Mark one only)

Ⓑ IF you attended graduate school, which is the area in which you took the most courses for credit? (Mark one)

Ⓒ Which areas would you recommend as the most useful for someone preparing for a job like yours? (Mark all that apply)

Ⓐ Ⓑ Ⓒ English
Ⓐ Ⓑ Ⓒ Languages (Foreign)
Ⓐ Ⓑ Ⓒ Other Arts and Humanities (Fine Arts, Music, Philosophy, etc.)
Ⓐ Ⓑ Ⓒ Economics
Ⓐ Ⓑ Ⓒ Sociology
Ⓐ Ⓑ Ⓒ Psychology
Ⓐ Ⓑ Ⓒ History
Ⓐ Ⓑ Ⓒ Other Social Sciences (Anthropology, Geography, Political Science, etc.)
Ⓐ Ⓑ Ⓒ Biological Sciences
Ⓐ Ⓑ Ⓒ Mathematical Sciences
Ⓐ Ⓑ Ⓒ Chemistry, Biochemistry
Ⓐ Ⓑ Ⓒ Physics
Ⓐ Ⓑ Ⓒ Other Physical Sciences (Earth Sciences, etc.)
Ⓐ Ⓑ Ⓒ Accounting
Ⓐ Ⓑ Ⓒ Business Administration
Ⓐ Ⓑ Ⓒ Other Business
Ⓐ Ⓑ Ⓒ Architecture, Urban Planning
Ⓐ Ⓑ Ⓒ Education
Ⓐ Ⓑ Ⓒ Engineering
Ⓐ Ⓑ Ⓒ Other Fields (specify): ____________

4. Looking back on your college education, please indicate the extent to which it has been useful in each of the following ways:

(Mark one for each line across)	Very Much	Somewhat	Not At All
It increased my general knowledge	Ⓥ	Ⓢ	Ⓝ
It increased my ability to think clearly	Ⓥ	Ⓢ	Ⓝ
It increased my leadership ability	Ⓥ	Ⓢ	Ⓝ
It taught me a skill that enabled me to get my first job	Ⓥ	Ⓢ	Ⓝ
It increased my chances of finding a good job	Ⓥ	Ⓢ	Ⓝ
It helped me choose my life goals	Ⓥ	Ⓢ	Ⓝ
It gave me knowledge and skills that I use in my current job	Ⓥ	Ⓢ	Ⓝ
My bachelor's degree was a factor in my being hired by my current employer	Ⓥ	Ⓢ	Ⓝ
My bachelor's degree was necessary to get promoted	Ⓥ	Ⓢ	Ⓝ
The contacts I made in college with professors or friends helped me get my current job	Ⓥ	Ⓢ	Ⓝ

5. Since you received your bachelor's degree, how many years have you been employed full time? (Mark one)

○ None ○ Less than 2 ○ 2–4 ○ 5–7 ○ 8 or more

6. Are you employed at the present time? (Mark one)

○ Yes (full-time) ┐
○ Yes (part-time) ┘—GO TO QUESTION 8
○ No —— ANSWER QUESTION 7

7. IF YOU ARE NOT EMPLOYED:

a. When did you last hold a job? (Mark one)

○ Within the last 3 months
○ 4 – 12 months ago
○ Over a year ago
○ Never

b. Why are you not employed at the present time? (Mark all that apply)

○ Do not want to be employed at the present time
○ Enrolled in school
○ Traveling, vacationing for an extended time
○ Prefer volunteer or community activity
○ Would like to be employed, but am apprehensive about seeking employment
○ Would like a part-time job (or a job with flexible hours), but am unable to find one
○ Spouse discourages employment
○ Involved with home, child care (voluntarily)
○ Involved with home, child care because unable to find adequate substitute care
○ Not sure how to go about seeking employment
○ Am not seeking work because I feel that I would be unable to find a job
○ Am seeking work, but am unable to find a suitable job
○ Moved to a new location, haven't found a job
○ Was released from my job due to a company cut-back
○ Illness, accident, or health problems
○ Other (specify): ____________

c. When do you plan to seek employment? (Mark one)

○ Am currently seeking employment
○ Within a year
○ 1 – 5 years from now
○ More than 5 years from now
○ Uncertain, but probably sometime in the future
○ Never

IF YOU ARE NOT EMPLOYED AT THE PRESENT TIME, BUT HELD A JOB IN THE PAST, PLEASE ANSWER THE REMAINING QUESTIONS WITH RESPECT TO THE LAST JOB YOU HELD. IF YOU ARE EMPLOYED, REFER TO YOUR CURRENT JOB.

8. What is:

Ⓨ Your current occupation? (Mark one only)

Ⓢ Your spouse's occupation? (Mark one only)

Ⓨ Ⓢ Accountant or financial analyst
Ⓨ Ⓢ Administrative assistant or middle level office worker
Ⓨ Ⓢ Administration – business (management at the executive level)
Ⓨ Ⓢ Administration – education (superintendent, principal, etc.)
Ⓨ Ⓢ Administration – government (manager, supervisor, etc.)
Ⓨ Ⓢ Allied health (hygienist, lab technician, therapist, dietician, nurse, pharmacist, etc.)
Ⓨ Ⓢ Architect or planner
Ⓨ Ⓢ Business owner or proprietor
Ⓨ Ⓢ Buyer or purchasing agent
Ⓨ Ⓢ Clergy, religious worker
Ⓨ Ⓢ Computer programmer
Ⓨ Ⓢ Computer scientist, systems analyst
Ⓨ Ⓢ Conservationist or forester
Ⓨ Ⓢ Communications specialist (reporter, writer, T.V., advertising, public relations, etc.)
Ⓨ Ⓢ Counselor (school, career, occupational, employment
Ⓨ Ⓢ Creative or performing artist
Ⓨ Ⓢ Engineer
Ⓨ Ⓢ Farmer or rancher
Ⓨ Ⓢ Foreign service worker (including diplomat)
Ⓨ Ⓢ Health professional (physician, dentist, optometrist, podiatrist, psychologist/analyst, veterinarian)
Ⓨ Ⓢ Librarian
Ⓨ Ⓢ Law enforcement worker
Ⓨ Ⓢ Lawyer (attorney)

Ⓨ Ⓢ Mathematician, statistician, or actuary
Ⓨ Ⓢ Military service
Ⓨ Ⓢ Sales or broker
Ⓨ Ⓢ Scientist – biological, physical, natural
Ⓨ Ⓢ Scientist – social
Ⓨ Ⓢ Secretary or clerk
Ⓨ Ⓢ Social welfare or community worker
Ⓨ Ⓢ Teacher (elementary or secondary)
Ⓨ Ⓢ Teacher or professor (at college, university, or other post secondary institution)
Ⓨ Ⓢ Technician
Ⓨ Ⓢ Transportation worker
Ⓨ Ⓢ Skilled worker (or apprentice)
Ⓨ Ⓢ Semi-skilled worker
Ⓨ Ⓢ Unskilled laborer
Ⓨ Ⓢ Other (specify): ____________

Ⓢ Not employed (housewife, volunteer worker, etc.)

hat point in your life did you ct your current occupation?
k one)
efore entering college
During college
Around graduation time
Within 5 years after graduation
More recently

ch category best describes the of organization in which you employed? (Mark one)
mmerce, finance, insurance, real estate
Manufacturing or construction
Retail or wholesale trade
Transportation or public utilities
Agriculture or mining
College, university, technical institute or professional school
Elementary or secondary school system
Other business or service establishments
uman services organization (social welfare, health, etc.)
.S. military service, active duty, or Commision Corps
.S. government, civilian employee
State, local, or other government
Other (specify): __________

roximately how many persons your company or organization loy? (Mark one)

work alone	○ 1,000 – 4,999
ess than 10	○ 5,000 – 9,999
0 – 49	○ 10,000 – 24,999
0 – 199	○ 25,000 or more
00 – 999	

QUESTION 12

12. Mark all work activities that:

Ⓐ You now perform on your job
Ⓑ Your college education prepared you to perform (whether or not you perform them on your job)
Ⓒ You would like to do but are not now doing

Ⓐ Ⓑ Ⓒ Accounting
Ⓐ Ⓑ Ⓒ Administration, management
Ⓐ Ⓑ Ⓒ Clerical
Ⓐ Ⓑ Ⓒ Counseling
Ⓐ Ⓑ Ⓒ Data processing, computer science
Ⓐ Ⓑ Ⓒ Engineering
Ⓐ Ⓑ Ⓒ Farming or forestry
Ⓐ Ⓑ Ⓒ Health service
Ⓐ Ⓑ Ⓒ Mathematical, statistical, actuarial
Ⓐ Ⓑ Ⓒ Performing or creative arts
Ⓐ Ⓑ Ⓒ Personnel, employee relations
Ⓐ Ⓑ Ⓒ Production, quality control
Ⓐ Ⓑ Ⓒ Program planning or budgeting
Ⓐ Ⓑ Ⓒ Promotion, public relations, advertising
Ⓐ Ⓑ Ⓒ Publications
Ⓐ Ⓑ Ⓒ Public safety, law enforcement, community service work
Ⓐ Ⓑ Ⓒ Research (laboratory)
Ⓐ Ⓑ Ⓒ Research (other)
Ⓐ Ⓑ Ⓒ Sales or marketing
Ⓐ Ⓑ Ⓒ Speaking to groups, discussion leading
Ⓐ Ⓑ Ⓒ Teaching
Ⓐ Ⓑ Ⓒ Technological design or construction
Ⓐ Ⓑ Ⓒ Technology (other)
Ⓐ Ⓑ Ⓒ Training
Ⓐ Ⓑ Ⓒ Writing, editing
Ⓐ Ⓑ Ⓒ Other (specify): __________

long have you been with this employer? (Mark one)
ess than 1 year
etween 1 and 2 years
etween 2 and 3 years
ore than 3 years

14. How satisfied are you with your current job?
(Mark one)
○ Very satisfied
○ Somewhat satisfied
○ Not at all satisfied

frequently do you use each of the following aspects our college education in your current job?

(Mark one for each line across)

	Almost Always	Frequently	Sometimes	Rarely	Never
the content of courses in my undergraduate major field	○	○	○	○	○
the content of courses in my undergraduate minor field	○	○	○	○	○
the content of other undergraduate courses	○	○	○	○	○
the content of courses taken for graduate credit	○	○	○	○	○

16. How closely related is your job to your undergraduate major field? (Mark one)
○ Closely related — Go to QUESTION 17
○ Somewhat related — CONTINUE
○ Not related — CONTINUE

Why are you working in a job only "somewhat" or "not" related to your undergraduate major? (Mark all that apply)

○ Never planned to take a closely related job
○ Prefer line of work not closely related
○ Tried closely related employment, but did not like it
○ First job was unrelated to major field and I became interested in this type of work
○ Joined family business or firm
○ Found a better paying job
○ Found a job that offers a better chance for career advancement
○ No longer in closely related job due to promotion
○ Wanted part-time work, flexible hours
○ Wanted to work at home
○ Am on a temporary assignment (VISTA, Peace Corps, USIA, foreign service, missionary work, etc.)
○ Jobs related to major are not available where I live and I do not want to move
○ Am in the military
○ Could not get a closely related job, but would prefer one
○ Limited in job selection by situation of spouse, family responsibilities
○ Very few jobs are related to my major
○ Employment opportunities are scarce for people in jobs related to my major

17. Aside from your college education, how did you acquire the knowledge or skills necessary for your job? (Mark all that apply)
○ Formal training at an outside institution
○ Company (or in-house) formal training program
○ On-the-job training
○ Picked it up myself
○ No training required

18. Indicate whether each of the following statements is correct in reference to your current job: (Mark all that apply)
○ I supervise people trained in my field of study
○ I am well paid for my work compared with persons of the same job level in my place of employment
○ I am well paid for my work compared with persons at the same job level in other work settings
○ I am well paid for my work compared with people in general with the same amount of education
○ Most of my colleagues are trained in my field of study
○ Most of the time I set my own work hours
○ Most of the time I design my own program of work
○ I have policy and decision-making responsibility
○ I am satisfied with the quality of interaction with my supervisor
○ I have sufficient status or prestige in my job
○ I am satisfied with my career progress to date
○ My current job offers good future prospects for further advancement
○ My job fits my long-range goals
○ I would like to remain with my current employer for the foreseeable future
○ My skills are fully utilized in my job
○ I am working at a professional level
○ During college I had a part-time or summer job related to my current job
○ I am self employed

PLEASE DO NOT WRITE IN THIS AREA

● ○ ○ ○ ○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○ ○ ○ ○ ○

○ ○ ● ○ ○ ○ ○ ○ ○ ○
○ ○ ● ○ ○ ○ ○ ○ ○ ○
● ○ ○ ○ ○ ○ ○ ○ ○ ○
● ○ ○ ○ ○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○ ○ ○ ● ○
○ ○ ○ ○ ○ ○ ● ○ ○ ○

19. What is your current annual salary before taxes? (If self-employed, indicate your annual earned income after adjusting for business expenses) (Mark one)

○ None	○ $17,000 – 19,999
○ Below $7,000	○ $20,000 – 24,999
○ $7,000 – 9,999	○ $25,000 – 29,999
○ $10,000 – 11,999	○ $30,000 – 34,999
○ $12,000 – 13,999	○ $35,000 – 39,999
○ $14,000 – 16,999	○ $40,000 and over

20. How many other full-time jobs (with different employers) have you held since you graduated from college? (Mark one)
○ None (same employer since graduation)
○ Have held one other job
○ Have held 2 – 3 other jobs
○ Have held 4 or more other jobs

21. Were any of your previous jobs closely related to your undergraduate major?
○ Yes ○ No

22. What is your sex?
○ Male ○ Female

23. What is your current marital status? (Mark on
○ Single (never married)
○ Married
○ Separated, divorced, widowed

24. Are you: (Mark all that apply)
○ White/Caucasian
○ Black/Negro/Afro-American
○ American Indian
○ Oriental
○ Mexican American/Chicano
○ Puerto Rican-American
○ Other

THANK YOU FOR YOUR COOPERATION

Return your questionnaire to:
HIGHER EDUCATION RESEARCH INSTITUTE
c/o Intran Processing Center
4555 West 77th Street
Minneapolis, Minnesota 55435

SCIENTIFIC
MANPOWER
COMMISSION

A Participating Organization of the
AMERICAN ASSOCIATION FOR THE
ADVANCEMENT OF SCIENCE
1776 Massachusetts Avenue, N.W.
Washington, D.C. 20036

202-223-6995
202-467-4325

May 8, 1978

Dear Colleague:

We are seeking your help to carry out one facet of a study of the labor force participation of women trained in science or engineering, and their utilization in the workforce. This study, supported by the National Science Foundation, will examine a number of questions.

What is the work experience of women who graduate in science and engineering? Are they less likely than men or than women who graduate in other fields to pursue a career? If so, why? How do the factors and impediments influencing the professional career of a woman scientist or engineer differ from those affecting men with similar education, or women in other fields?

The impetus for the study is a disturbing statistical finding by the National Science Foundation that almost half (47%) of all women scientists and engineers were voluntarily out of the workforce in 1974, compared to only 12% of the men, and compared to 36% of all women with four or more years of college. Our purpose is to determine whether this finding continues in data for later years, and to examine reasons for the temporary or permanent withdrawal from the labor force of women trained in science and engineering. The findings will result in recommendations designed to improve professional opportunities for women in these fields.

In addition to analyzing data from other studies, we are contacting a small and select sample of women graduates in chemistry and engineering over the past 20 years, with assistance from their colleges and universities.

As a graduate in engineering from Purdue University, we hope you will help us to accomplish this part of our study by completing the enclosed questionnaire and returning it in the self-addressed envelope before June 2. All responses will, of course, be kept fully confidential. Neither individual respondents nor participating schools will be identified. If you would like a summary of the findings, please write your name and address on the enclosed label and return it with your questionnaire.

Whether you are a former, present or aspiring re-entrant member of the science and engineering workforce, we need your help. This questionnaire represents a sizeable intrusion in your busy schedule, but we hope you agree that the goals of the study justify the effort.

Sincerely,

Betty M. Vetter

Betty M. Vetter
Executive Director

American Anthropological Association
American Association for the Advancement of Science
American Astronomical Society
American Chemical Society
American Institute of Biological Sciences
American Institute of Chemists
American Institute of Physics
American Psychological Association
American Statistical Association
Conference Board of the Mathematical Sciences
Federation of American Societies for Experimental Biology

SCIENTIFIC MANPOWER COMMISSION
STUDY OF WOMEN GRADUATES IN SCIENCE AND ENGINEERING

1. **DATE OF BIRTH**

____
Mo. Day Year

2. **MARITAL STATUS:** ☐ Single, never married (Go to question 4)
☐ Separated, Divorced, Widowed
☐ Married

A. If now or formerly married, check his highest education:

☐ Some High School
☐ High School Graduate
☐ Some College
☐ Bachelor's Degree
☐ Master's Degree
☐ Doctor's or Professional Degree

B. Husband's occupation is: (was)
☐ in a field closely related to mine.
☐ in a field somewhat related to mine.
☐ in an unrelated field.

3. **PARENTAL STATUS:**

Number of Children	Age 0-6	7-12	13-18	19+
None				
One				
Two				
Three or more				

4. **RACE/ETHNIC IDENTIFICATION**

☐ White/Caucasian
☐ Black/Negro
☐ American Indian
☐ Hispanic
☐ Asian

5. Are you physically handicapped? ☐ Yes ☐ No

6. **HIGHER EDUCATION**

College or University	Years Attended	Major Field	Degree & Year

7. **CURRENT EMPLOYMENT STATUS** (Check and complete one answer, A through G)

☐ A. Employed in science or engineering position ☐ Full-time ☐ Part-time
If part-time, are you seeking full-time employment? ☐ Yes ☐ No
(Go to question 8)

☐ B. Employed in non-science/engineering position ☐ Full-time ☐ Part-time
1. If employed part-time, are you seeking full-time employment? ☐ Yes ☐ No
2. Reason for accepting position unrelated to science or engineering:
   - ☐ a) Prefer non-science or non-engineering position
   - ☐ b) Promoted out of science/engineering position
   - ☐ c) Better salary in non-science/engineering position
   - ☐ d) Location of job preferred over other considerations
   - ☐ e) Science or engineering job not available
   - ☐ f) Other (Specify)_______________

(Go to question 8)

☐ C. Postdoctoral Appointment (fellowship, traineeship, etc.) (Go to question 8)

☐ D. Unemployed and seeking employment, ☐ Full-time ☐ Part-time ☐ Either one
- Major difficulties in finding employment: (Check all that apply)

☐ a) Finding a suitable job in my field
☐ b) Lack of geographic mobility
☐ c) Finding adequate child care
☐ d) My professional skills are out of date or rusty
☐ e) Salary offers have been too low to be acceptable
☐ f) Sex, age and/or race discrimination
☐ g) Anti-nepotism rules
☐ h) Other (Specify)_______________
(Go to question 8)

(OVER)

7. CURRENT EMPLOYMENT STATUS (continued)

☐ E. Unemployed and not seeking employment

1. Major reasons for not seeking employment (Check all that apply)

   - ☐ a) Pregnancy and/or desire to devote full-time to family
   - ☐ b) Graduate Student ☐ Full-time ☐ Part-time
   - ☐ c) No suitable job in my field
   - ☐ d) Professional skills are out of date or rusty
   - ☐ e) Unfavorable family attitudes toward my career involvement
   - ☐ f) Geographical location of jobs
   - ☐ g) Salary offers too low to be worthwhile
   - ☐ h) Demands of husband's career
   - ☐ i) Anti-nepotism rules
   - ☐ j) Personal health reasons
   - ☐ k) Other (Specify)______________________________

2. Do you plan to return to the labor force? ☐ Yes ☐ No (If No, go to 8)
   - If yes, when?______________(Date)
   a) Do you expect to seek a job in science or engineering? ☐ Yes ☐ No
   b) Do you expect to need refresher courses in science/engineering? ☐ Yes
   (Go to question 8) ☐ No

☐ F. Retired and Not Employed (Go to question 8)

☐ G. Other (Specify)__________________________________

8. PROFESSIONAL WORK EXPERIENCE (Exclude casual or temporary jobs and part-time work while an undergraduate student)

A. Have you ever been professionally employed? ☐ Yes ☐ No (If no, go to question 9)

B. Work History (List in order, present or most recent job first)

DATES (From	To)	JOB TITLE	PRINCIPAL ACTIVITY (See Codes)	TYPE OF EMPLOYER (See Codes)	SALARY (Start/Finish)
1.					
2.					
3.					
4.					

Principal Activity

01 Teaching
02 Research, Development
03 Technical Management
04 Non-technical Management
05 Computer Applications
06 Consulting
07 Other Professional Practice
08 Sales, Marketing, Service
09 Writing, editing, etc.
10 Secretarial, Clerical
11 Other (Specify)

Type of Employer

01 College or university
02 Elementary or Secondary School
03 Private Industry or business
04 Federal government
05 State or local government
06 Non-profit organization (Other than educational institution)
07 Self-employed
08 Military service
09 Other (Specify)

C. For jobs listed above, circle the number indicating relatedness of job to your highest degree field.

	DEGREE IN FIELD REQUIRED	NOT REQUIRED BUT HIGHLY RELATED	SOMEWHAT RELATED	NOT RELATED
Job 1	1	2	3	4
Job 2	1	2	3	4
Job 3	1	2	3	4
Job 4	1	2	3	4

3. PROFESSIONAL WORK EXPERIENCE (continued)

D. Number of years since baccalaureate you have worked in a science or engineering job:

__________ Years, Full-time __________ Years, Part-time

E. Number of years since baccalaureate you have worked in non-science/engineering job:

__________ Years, Full-time __________ Years, Part-time

F. Number of years not employed since bachelor's degree: __________ (years)

9. CAREER INTERRUPTIONS

A. Since completing your baccalaureate degree, have you ever been away from full-time employment for six months or more? ☐ Yes ☐ No (If No, go to question 10)

B. How many such breaks in employment have you experienced? __________

C. What was the longest such break? __________ (Years) __________ (Months)

D. How long was the most recent break? __________ (Years) __________ (Months)

E. What were the reasons for these breaks? (Check all that apply)

	Longest Break	Most Recent if different	All Other Breaks
a) Return to school			
b) Getting Married			
c) Pregnancy			
d) Desire to devote more time to family			
e) Changing professional field			
f) Personal health			
g) Geographical move			
h) Lost job, could not find another			
i) Other (Specify)			

F. Did you return to professional employment after most recent break?
☐ Yes ☐ No ☐ Currently seeking employment

10. CAREER DEVELOPMENT: To what extent have the following factors had a negative effect on your career development and/or involvement?

	Not Applicable	Little or No Impact	Moderate Impact	Major Impact
A. Inadequate funds for education				
B. One or more young children at home				
C. Inadequate household help				
D. Attitude of family against career				
E. Attitude of friends against career				
F. Little financial incentive to work				
G. Unsatisfactory job opportunities				
H. Demands of husband's career				
I. Other demands on time (family, social)				
J. Personal health				
K. Sex, race or age discrimination				
L. Geographical location of jobs				
M. Travel demands of job				

PLEASE ADD ANY OTHER COMMENTS ON THE BACK OF THIS PAGE. THANK YOU FOR YOUR TIME.

Please return completed questionnaire to:
Scientific Manpower Commission
1776 Massachusetts Ave., N.W.
Washington, D.C. 20036

NAME __________
(Optional)
ADDRESS __________
____